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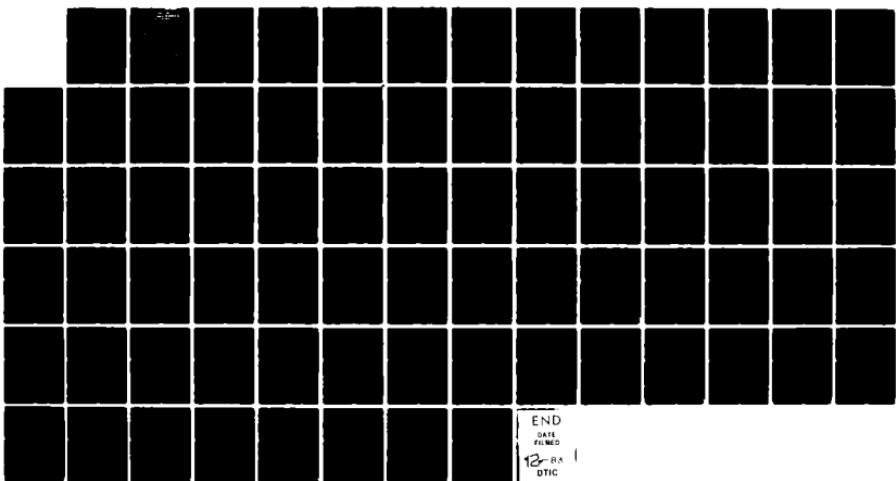
MISSISSIPPI RIVER: STUDY OF ALTERNATIVES FOR
REHABILITATION OF LOCK AND D... (U) CORPS OF ENGINEERS ST
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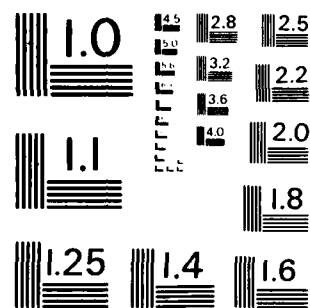
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AD-A134 264

STUDY OF ALTERNATIVES FOR REHABILITATION
OF LOCK AND DAM NO. 1
MINNEAPOLIS, MINNESOTA

SUPPORTING DATA
FOR
APPENDIX A
ALTERNATIVE PLANS OF REHABILITATION

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ST. PAUL, MINNESOTA

APRIL 1976

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number) LOCKS (WATERWAYS) INLAND WATERWAYS MISSISSIPPI RIVER		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) It is recommended that both the landward lock, the riverward lock and the dam at Lock & Dam no. 1, Minneapolis, Minnesota be completely rehabilitated. Based on studies completed to the date of this report, more detailed studies are required to firmly establish cost estimates, environmental effects, and the construction scheduling necessary to insure the work can be completed in the proposed two year construction period without delaying navigation.		

DEPARTMENT OF THE ARMY
St. Paul District, Corps of Engineers
1210 U. S. Post Office & Custom House
St. Paul, Minnesota 55101

MISSISSIPPI RIVER

STUDY OF ALTERNATIVES FOR REHABILITATION OF LOCK AND DAM NO. 1
MINNEAPOLIS, MINNESOTA

SUPPORTING DATA
FOR
APPENDIX A
ALTERNATIVE PLANS OF REHABILITATION

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HARZA
ENGINEERING
COMPANY
CHICAGO

SUBJECT: SUPPORTING DATA - APPENDIX A
ALTERNATIVE PLANS OF REHABILITATION

PROJECT: LOCK & DAM NO. 1
FILE NO. 800 A
DATE 4/24/75 PAGE 1 OF 1 PAGES

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HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>Cost Estimate</u> <u>Excavation and Embankments</u>	PROJECT <u>Lock & Dam No 1</u> FILE NO <u>00019</u> DATE <u>1/21/75</u> PAGE <u>1 of 65</u>
	COMPUTED <u>GJK</u>	CHECKED

Figure costs for the various types of excavation for Lock & Dam No. 1. As before use current labor rates for Minneapolis & current equipment costs from CECRS. Use 35% for profit & overhead. Add 15% for escalation. Note: Relatively insignificant items will not be covered in these notes.

Dredging:
use backhoe on the bank, figure low production rate for under water work. Say 1 cu. yd. machine at 30 cu/hr.

1 Operator	8.90	8.90
1 Oiler	8.00	8.00
3 Truck Dr.	7.20	21.60
2 Flagman	7.70	<u>15.40</u>
		<u>53.90</u>
	W/OT at 8.3%	
1 Backhoe	58.40	58.40
3 10 cu Trk. on highway	24.00	
	<u>57.00</u>	
	81.00	<u>81.00</u>
		<u>129.40</u>

Per cu.yd.
W/profit, overhead 35% 6.27
W/Esc. 15% 7.21
Small quantity 450 \$9.00

Backhoe excavation for structures

Say product would be 30 cu/hr Add disposal separately

1 Oiler & Operator w/OT	18.30
Backhoe	24.00
2 Flagmen w/OT	<u>16.70</u>
Direct	59.00
per cu (.50)	1.18
Add Disposal	<u>1.49</u>
Total Direct	<u>3.67</u>
55%	w/ Profit, overhead & Esc. 5.68
	450 \$6.00/cu.yd.

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>Cost Estimate</u> <u>Excavation and Embankments</u>	PROJECT <u>Lock & Dam 11</u> FILE NO <u>8001</u> DATE <u>4/4/75</u> PAGE <u>2</u> OF <u>65</u>
COMPUTED <u>GJK</u>	CHECKED _____	

Figure Disposal Costs for Various Distances
Truck cycle: 10 cu on-Highway Truck

	<u>1 mi</u>	<u>3 mi</u>	<u>5 mi</u>	<u>10 mi</u>
Load	5.0	5.0	5.0	5.0
Haul	4.0	10.0	12.0	21.0
Dump	3.0	3.0	3.0	3.0
Return	3.3	9.0	13.0	21.4
Load	<u>0.7</u>	<u>1.0</u>	<u>2.0</u>	<u>3.6</u>
Total	18.0	28.0	38.0	57.0
Trips/Hr	2.8	1.8	1.3	0.9
Production cu/hr	28	18	13	9

Labor, w/oT	7.00	→		
Truck	<u>19.00</u>	→		
Direct Cost	<u>\$ 26.80</u>	—	—	—
per cu yd	<u>\$ 0.96</u>	1.49	2.06	2.98

Add Fragmen separately

use this.
or \$2.30 w/prof. O.H. & Z.S.

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>Cost Estimate</u> <u>Excavation and Embankments</u>	PROJECT <u>Lake & Dams No. 1</u> FILE NO <u>800 A</u> DATE <u>1/2/75</u> PAGE <u>3</u> or <u>65</u> PAGE
	COMPUTED <u>GJK</u>	CHECKED <u>JH</u>

Front end Loader excavation, for alluvial deposits and backfill excavation in open areas.

Say we'll use a 2 cu with a production of $2 \times 30/.75 = 120$ cu/hr. Assume 30% dozer assistance.

Labor

1 FEL oper.	8.90
30% 1 Dozer oper.	8.70
2 Flag men	15.40
1 MISC Common	<u>7.70</u>
	<u>34.60</u>
W/OT (1.082)	37.50

Equipment

1 FEL 2 cu	15.00
30% 1 Dozer D-7	19.50
Total	<u>58.35</u>
SubTotal Direct	58.35
Per cu yd	0.45
Add Disposal	<u>1.49</u>
Total Direct	<u>1.94</u>
Profit & Overhead	0.67
w/ Esc	.39
use	<u>\$ 3.00</u>

Use this for acc. rd. removal

Land sparse

Use all as above but add full time dozer-ripper. Say production drops to 90 cu/hr

Labor & Equip above	58.35	(3/11/75) ✓
add .7 Dozen op. W/OT	6.60	NOTE - for
add ripper to D-7	<u>3.00</u>	small quant,
Total	67.95	close gtrs, use
Per cu yd	0.76	\$15.00/c.y
Add Disposal	<u>1.49</u>	
w/ Profit & OH & Esc.	3.48	
use	<u>\$ 3.50</u>	

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HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>Cost Estimate</u> <u>Excavation and Embankments</u> COMPUTED <u>GJK</u>	PROJECT <u>Lock & Dam 16 1</u> FILE NO <u>800 A</u> DATE <u>1/2/75</u> PAGE <u>1</u> OF <u>65</u> PAGE
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Clamshell excavation - for cofferdam removal and rock like excavation.

Assume a 3 cu yd crawler crane loading trucks with 180° swing. $3 \times 50 / 0.90 = 166$; use .90 cu yds/hr per due to truck maneuvering.
(Using small on highway haul units)

Labor - operator	8.90
oiler	8.00
4 Flagmen	7.70 30.80
2 misc	<u>15.40</u>
	63.10
W/OT	68.30
Equipment - Clamshell	<u>54.20</u>
Sub Total	122.50
Per cu yd	1.36
Add Disposal	1.49
Total	<u>2.85</u>
W/Profit & Overhead	3.84
W/Escalation	4.41
use	4.50 ✓

Double this for crib removal

Stripping - use same as FEL excavations.

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>Cost Estimate</u> <u>Excavation and Embankments</u>	PROJECT <u>Lock E Dam No. 1</u> FILE NO <u>800 A</u> DATE <u>1/21/73</u> PAGE <u>5</u> OF <u>65</u> PAGE
COMPUTED <u>GJK</u>		CHECKED _____

Figure Fill Costs for Lock E Dam No 1. Same assumptions as before. Assume all but random fill has to be purchased.

Access Road Random fill

Say that 12,000 cu of this 19,000 cu fill can come from Land wall backfill excavation.

The remainder will come from borrow say 8 mi away.

Placing only: say a D-8 w/towed roller can place and compact 150 cu/hr.

Labor: { 1 Dumperman	8.35
w/OT { 1 Dozer oper	9.45
	<u>17.80</u>
D-8 Dozer	29.00
Tow ^{ed} Sheepfoot Roller	1.20
	<u>30.20</u>
Total Direct	40.00
per cu.yd. (150)	0.32

Borrow and Haul and Place

from 8 miles truck production would be about 11 cu/hr/truck for 110 yd³/hr use 10 trucks

Labor 1 FEL op	8.90
10 Truck dr	72.00
4 Misc Flag men	7.70 30.80
1 Placing crew	<u>17.80</u>
	<u>129.50</u>

Equipment

1 2cu FEL	15.00
10 Truck 10 cu	190.00
1 Dozer w/roller	<u>30.20</u>
	<u>235.20</u>
Total Direct	264.20

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>COST Estimate</u> <u>Excavation and Embankments</u> COMPUTED <u>GJK</u>	PROJECT <u>Lock & Dam No 1</u> FILE NO <u>800 A</u> DATE <u>1/2/25</u> PAGE <u>6</u> OF <u>65</u>
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Access Road Random Fill

B,H&P. Total Direct 364.70
per cu (.110) 3.31

Composite Price

12/19 x 0.32 0.20
7/9 x 3.31 1.22

Composite Direct 1.42

w/ 35% Profit & OH 1.92

w/ 15% Esc 2.20

HSE 2.50/cu

use \$ 3.00/cu for Access Ramp

for Land Cells

Granular Cell Fill

Purchased material, barged from downstream 8 mi.
Local quote, say gravel & sand at \$2.00/bcu avg.

Say 1.5 ton/cu or 3.00/cu

Hauling 8 mi 8 x .15 x 1.5 = 1.80/cu

Total mat'l 4.80/cu delivered

Place by clamshell at 100 cu/hr

1 operator 8.90

1 oiler 8.00

1 misc 7.70

24.60

w/ot 26.65

1 clamshell 54.20

80.85

per cu 0.81

Add mat'l's 4.80

5.61

w/ Profit & OH 7.57

w/ Esc 8.70

use \$ 9.00/cu

4.50

\$ 13.50

remove @

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>Cost Estimate</u> <u>Excavation and Embankments</u>	PROJECT <u>Lake of the Woods No 1</u> FILE NO <u>800 A</u>
	COMPUTED <u>GJK</u> CHECKED _____	DATE <u>4/2/25</u> PAGE <u>7 OF 65</u>

Impervious fill

Placed by clamshell from barges, spread by dozer & roller. Say 100 cu/ hour

labor

1 Crane op	890
1 oiler	800
1 Dozer op	870
1 Dumperman	710
2 misc.	<u>1540</u>
	48.70
W/OT	52.75

Equipment

1 Clamshell	54.00
1 Dozer	30.20
1 Roller	<u>3</u>
2 gas tamper	<u>450</u>
	<u>88.70</u>
	141.45

Per cu 1.41
w/ material purchase 4.50
5.91

w/ Profit & Overhead 7.98
w/ ESC 15% 9.17

use # 9.00/cu + 3.00 for removal

Dumped Rock, Rip rap, Random Rock fill

Purchase & deliver # 9.00/cu

Place w/ clamshell 1.00
10.00

w/ Profit & overhead 13.50
w/ ESC 15.52

Hand placed use { # 16.00/cu + 4.50 remove } when
25.00/cu + 4.50 remove rigid.

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HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>Cost Estimate</u> <u>Excavation and Embankments</u>	PROJECT <u>Lock & Dam No.</u> <u>800 A</u>
COMPUTED <u>GJK</u>	CHECKED	FILE NO.
		DATE <u>1/2/75</u> PAGE <u>8</u> OF <u>65</u> PAGES

Gravel & Gravel Filters

Purchased & hauled placed by clamshell from barges
spread by Dozer & roller. Purchase 6.00

Place	<u>0.75</u>
	<u>6.75</u>

w/ Profit 6.04	<u>9.11</u>
----------------	-------------

w/ Esc.	<u>10.50</u>
---------	--------------

$10.50 + 3.00 = 13.50$ (removed) use \$13.50 to incl. removal
if reqd.

Back fill around structures

Hand compacted material from excavation
Dozer placed. Production say 20 cu/m

1 Dozer op	<u>8.10</u>
------------	-------------

4 Compaction	<u>30.80</u>
	<u>39.50</u>

W/OT	<u>42.75</u>
------	--------------

1 Dozer D-7	<u>19.50</u>
-------------	--------------

4 gas tamper	<u>9.00</u>
	<u>28.50</u>

	<u>71.25</u>
--	--------------

per cu	<u>3.56</u>
--------	-------------

w/ Profit 6.04	<u>4.80</u>
----------------	-------------

w/ Esc	<u>5.53</u>
--------	-------------

use \$6.00/cu

In larger back fill sites say 75% machine
compaction 25% hand compaction

Page 4 .70 x 0.32 = 0.24

.25 x 3.56 = <u>0.89</u>

<u>1.13</u>

w/ Profit 6.04	<u>1.53</u>
----------------	-------------

w/ Esc	<u>1.75</u>
--------	-------------

say # 2.00/cu

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>Cost Estimate</u> <u>Steel Sheet Piling</u>	PROJECT <u>Lock & Dam No. 1</u> FILE NO. <u>800 A</u>
	COMPUTED <u>JAT</u> CHECKED _____	DATE <u>1/7/75</u> PAGE <u>9</u> OF <u>65</u> PAGES

1. Temp. Work

Sheet Piling

1). Drive, Pull & Salvage

Based on previous bidding experience and
Means Construction Cost Data 1975

Labor & Equip. to drive & extract	\$ 213.00/Ton
Piling etc. @ 75% salvage value	75.00
Waste allowance 10% of \$300.00	<u>30.00</u>
	<u>318.00</u>

(due to the fact that some may be driven from barge)	Add 20% for difficult conditions	<u>62.00</u>
		<u>380.00</u>
	Profit & Overhead 35%	<u>133.00</u>
		<u>513.00</u>
	Escal. 15%	<u>77.00</u>
		<u>\$ 590.00</u>
	Use \$ 600.00/Ton	

2) Drive & Leave in Place

Labor & Equipment to drive Piling	<u>142.00</u>
	<u>300.00</u>
	<u>442.00</u>

Prof & O.H. 35% ±	<u>158.00</u>
	<u>\$ 600.00</u>
Escal 15%	<u>90.00</u>
	<u>\$ 690.00</u>
Use \$ 700.00	

3) Trim Piles \$ 200 /lin.ft.

Pumping - Roughly \$ 350.00/day

HARZA
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CHICAGO

SUBJECT Cost Estimate
Shelter for Winter Work

COMPUTED GJK

CHECKED JAT

PROJECT Lock & Dam 1
FILE NO. 800-A
DATE 12/3/74 PAGE 10 OF 65

Figure the cost of winter protection for Lock & Dam No 1. Use current labor rates and material prices for Minneapolis from ENR. Use equipment hourly costs from CECRG. Add escalation at 15% per year for one year. (Construction will be in Nov, '74 as per DAD schedule). Use 25% of direct costs for contractor's profit & overhead.

The job will consist of erecting a column supported roof truss over the locks, placing a wood and tar paper roof deck and enclosing the frame with canvas.

Crew sizes and production rates:

- a) Drillers - say an 8 man - layout, drilling and grouting crew can do about 40 ft. of drilling per hour. say 4 holes per column, 110 ft. deep or $51 \times 4 \times 4 = 816$ lin ft
Total job time $816/40 = 20.4$ hour say 2-8 hr days
- b) Steel Erection - use a crew of steel workers and equipment operators w/ truck crane to erect about 17 Tons of steel per 8 hr day.
say $300/17 = 17.6$, 3 weeks, 6 days/week
- c) Wood & Tar Paper - use a crew of 7 men assisted by a crane to place 600 sq ft/hr Total job time $510 \times (56+56+29)/600 = 120$ hrs per crew, say $120/48 = 2.5$ wks total
- d) Canvas - say the wood & paper crew can do this work in a week
- e) Hauling: Assume that two trucks can bring in enough materials to keep up with production - 3 $\frac{1}{2}$ wks
- f) Total Job time 3 $\frac{1}{2}$ wks.

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CHICAGO

SUBJECT Cost Estimate
Shelter for Winter Work
COMPUTED GJK

PROJECT Lock E. Dam No. 1
FILE NO. 800 4
DATE 12/9/74 PAGE 11 OF 65

1) Drilling and Placing Anchor bars - say 3 days or 24 hrs

2 Drillers	8.45	16.90
1 Helper		7.70
1 Air comp op		8.15
2 Grout & Bar men	7.10	15.40
1 Layout man - misc.		7.70
O.T. for 6 day week $40 + (0.5 \times 8)$	143	<u>55.85</u>
Add 8.3% $\frac{143}{143}$		\$ 60.50
For 24 Hrs		\$ 1452.00

Equipment

1 Air comp	250	9.00
2 Jackhammers	.35	0.70
1 Misc. grout tools		0.30
		10.00

For 24 Hrs \$ 240.00

Materials

Threaded bars 1 1/2" dia (arbitrary)		
6 #/FT $\times .30/16 \times 816 =$		\$ 1469.00
Drill steel .40/LF $\times 816$		326.00
Grout w/waste, 20 cuft, \$18/cuft.		360.00

Total Direct	\$ 3847.00
w/ Profit & OH 35%	5193.00
(by 816) w/ ESC 15% per lin. FT.	\$ 6000.00
	\$ 7.34

2) Steel Erection - From Means & Stubb's, 17 Tons/hr
Labor

1 Foreman	12.00
4 S.H. Worker	9.95 39.80
90% 1 Crane op.	8.90 8.00
90% 1 Oiler	8.00 7.20
1 Compt op	8.15
2 Common	7.70 15.40
80% 2 Truck Dr.	7.20 11.50
	<u>102.05</u>

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>Cost Estimate</u> <u>Shelter for Winter Work</u>	PROJECT <u>Lock E' Dam No.</u> <u>800 4</u>
	COMPUTED <u>GJK</u>	CHECKED <u>JAT</u>

2) Steel Erection - cont'd

Labor	per hr.	102.05
w/OT at 8.3%		110.50
for 3 wks, or 144 Hrs		\$ 15,912.

Equipment 80% 2 Trucks	20.00	32.00
90% 1 Truck Crane 25 T.	17.00	15.30
1 Air Compr.		9.00
4 Torque Wrenches	0.60	2.40
Misc. Clamps Hoses, Equip		<u>1.30</u>
		60.00

for 18 days 144 Hrs \$ 8,640

Materials

Roof Trusses, 164 tons or 328000 ft		
at 28¢/lbs. x 328000		91,840.
Struct. Beams .18¢/lbs. x 172,000		30,960.
Struct. Angles .20¢/lbs x 100,000		20,000.
Bolts, etc.		<u>1484</u>

Total Direct	say	\$ 170,000
w/ Profits Overhead		\$ 229,500
w/ Ex 15% say	263,925	256,000.
	<u>say</u>	265,000

3) Roofing - crew of 7 at 600 SF/hr - 2.5 wks.

Labor

1 Foreman		12.00
32% 1 Crane op		8.90 2.85 -
44% 2 Truck dr.		7.20 6.35 -
2 Carpenter		9.20 18.40 -
4 Common		7.70 30.80 -
32% 1 Oiler		8.00 2.25 -
		.72.95

w/OT at 8.3%		79.00
for 15 days, 120 Hrs		\$ 9480.

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SUBJECT Cost Estimating
Shelter for Winter Work
COMPUTED GJK CHECKED JAT

PROJECT LOCK E 12001
FILE NO. 600A
DATE 12/9/74 PAGE 13 OF 65

3) Roofing, canvas

Labor

Equipment

32% Crane	17.00	5.45
44% Z Truck	20.00	17.60
Misc Tools		0.95
		<u>24.00</u>

for 120 Hrs

9480.

Materials

Lumber	143 MDF at \$220/m ³	31460.
Tar Paper	95,000 SF at \$1.00/100 #	
15 sf/pct,	95000 X 1.00 X .15/9	<u>11,050.</u>

Total Direct

w/ Profit & OH & Exc. (about) # 54,900

w/ Profit & OH & Exc. (about) # 85,000.

4) Canvas

Labor Crew above, 72.00 x 48	3504
Equipment - Crane 5.45 x 48	262
Materials, say 5#/SF x 27,000	<u>1350</u>
	<u>3116</u>
w/ Profit & OH & Exc. (about) #	8,000.00

5) Summary

1) Drilling	6,000.00
2) Steel Erection	265,000.00
3) Roofing	85,000.00
4) Canvas	<u>8,000.00</u>
Erection	<u>364,000.00</u>
	<u>365,000.00</u>

Removal - (see page 5)

1 Anchor Bolts	650.00
2 Steel	(26,000.00)
3 Roofing	20,000.00
4 Canvas	<u>3000.00</u>
	<u>(2350.00)</u>

Total Job \$362,000

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CHICAGO

SUBJECT Cost Estimate
Shelter for Winter Work
COMPUTED GJK CHECKED JAT

PROJECT Lock & Dam No 1
FILE NO. 800-11
DATE 12/19/74 PAGE 14 OF 65

Removal

1) Anchor Bolts - 40 Bolts/hr

Labor - 2 Common 7.70 x 1.083 16.70

Equipment - Cutting Torch 0.50

Grinder 0.15

Hourly Total 17.35 \$/hr

W/ P. OH & ESC 27.00 \$/hr

for 24 Hrs say \$650.00

2) Steel Framing - say the steel crew can dismantle about 25 tons/day, assisted by a crane, say steel will be sold to buyer who picks it up on site at 30% Purchase Price.

Labor - steel crew w/b Truck dr. 90.55

W/ OT 96.00

Equipment - No Trucks 28.00

Subtotal 126.00

For $\frac{300}{25} = 12$ days 12,096

W/ Profit & Overhead & ESC 18,780

Steel Salvage

$148,800 \times .30 =$ (44,640)

Net Salvage (25,860)

say (26,000)

3) Roofing - man's says 4 laborers can remove 4000 SF/day - 8hr. use 10 for 10,000 SF/
 $143/10 = 15$ days or 120 Hrs. day

Labor 1 Foreman 12.00

10 Common 7.70 77.00

20% Crane op 8.90 1.80

20% Oiler 8.00 1.60

92.40

W/OT \$ 100.00/hr

Equip. 20% Crane 3.40

Misc. 1.60

Total \$ 105.00

W/ Profit OH & ESC 163.00

4 Canvases - 50% labor & canvas 120 Hrs say \$19,560 \$20,000

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HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>Cost Estimate</u> <u>Shelter for Winter Work</u>	PROJECT <u>Lock & Dam No. 1</u>
	COMPUTED <u>JAT</u>	FILE NO <u>800A</u>
		DATE <u>1/1/75</u> PAGE <u>15</u> OF <u>65</u> PAGES

Heat Temporary Shelter
2,200,000 cu.ft. — poorly insulated. 5 months

Assuming a well insulated area costs about \$0.025
per cu.ft., the poorly insulated shelter might
cost \$0.10/cu.ft. for the 5 months

— or use \$250,000.00 Plan No.1
Double for Plan No.2

Lighting & Pumping - use \$10,000 for each.

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>Cost Estimate</u> <u>Removal of Concrete</u>	PROJECT <u>Lock & Dam No. 1</u> FILE NO. <u>800A</u> DATE <u>11/10/75</u> PAGE <u>16</u> OF <u>65</u>
COMPUTED <u>JAT</u>	CHECKED _____	

Removal of Existing Concrete -

This material must be drilled and light blasted
generally from bottom to top in the case of new
conduit excav. Compute typical round of 3.5'

CROSS SEC 120 Sq. ft.

No. of drill holes use 60 @ 4' depth : 240

Drill time - with 4 drills =

$$@ 0.6 \text{ min./drill} \frac{240}{2.4} = 100 \text{ min}$$

$$(\text{vol./round} = (10 \times 12 \times 3.5) : 27 = 58 \text{ yd}^3)$$

$$\text{load \& shoot } 60 \times 2 : 2 (2 \text{ min}) \quad 60$$

$$\text{muck out} \quad 30$$

$$\text{set up drills} \quad \frac{30}{220 \text{ min}}$$

$$\text{Cost/round:} \quad = 3.66 \text{ hrs} - \text{use 4.5 hrs}$$

Labor:

drillers, powdermen, front
end loader oper., welder for
old rebars, compressor oper.,
truck driver, other labor

$$\text{say } 15 @ \$8.00 \times 4.5 = \quad 540.00$$

$$\text{Equipment about } 9 \text{ acy/hr} = \quad 405.00$$

Materials

$$\text{Drill Std, bits, explosives} \quad 80.00$$

$$\text{Total} \quad \underline{1,025.00}$$

$$\underline{1,025 \times 1.35 \times 1.15 = \$ 106}$$

$$15 \quad \text{Use } 110.00 \text{ / cu.yd.}$$

Use this for conduit excav. and enlarging
conduits

Removal of concrete - not involving tunnel oper -

- use \$65.00 / cu.yd.

For bore slots involving mostly air hammer work \$150.00/c.y.
Same for 3.5' roof depression

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HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>Cost Estimate</u> <u>Removal of Concrete</u>	PROJECT <u>Lock & Dam No. 1</u> <u>800A</u>
COMPUTED <u>6/1K</u>	CHECKED <u>JW</u>	FILE NO. DATE <u>3/20/72</u> PAGE <u>17 or 65</u> PAGES

Removal of Concrete - Revised w/o blasting.

From Meini's Costs 1975 a crew consisting of a foreman, compo oper., and 4 laborers can remove about 2.5 cu of reinforced concrete per 8 hr day w/o blasting. Figure 12 laborers plus foreman, ladder oper, welder and compo op. 16 men in all to produce 1 cu/hr.

labor $16 \times \$8.00/\text{hr. avg.} = \128.00 $\$128.00$
Equipment

12 jackhammers	0.30	1.20
2 900 cfm air compress	14.00	28.00
1 welding set		0.30
10% / F.E.L. - carrying loading	15.00	1.50
Misc Hoses	3.80	<u>3.80</u>
		<u>35.00</u>
		<u>$\\$35.00$</u>

Materials - Drill Steel, Bits
 $12 \times 0.6 \times 50 \times 304$ $\$100.00$

per hr. $\$271.00$

use for tunnel work $\$270.00/\text{cu}$
 $270 \times 1.35 \times 1.15$ (W/Prof & O.H. & Esc) = 527 $\$420.00/\text{cu}$.

where blasting is permitted outside tunnels
use as before $\$65.00$

For Gate slot - air hammer work in the open
use as before $\$150.00$

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>Cost Estimate</u> <u>Slurry Trench</u>	PROJECT <u>Lock & Dam No. 1</u> <u>800A</u>
COMPUTED <u>JAT</u>	CHECKED _____	DATE <u>1/13/75</u> PAGE <u>18</u> OF <u>65</u>

Drains - Perf. Clay Pipe (Means Constr. Cost Data '75)
 12" $\$4.70 \times 1.35 \times 1.15 =$ say $\$8.00/\text{ft.}$
 24" Use $\$15.00/\text{lin.ft.}$

Slurry Trench 180 cu.yd.
 Excavation, Slurry and Earth Backfill usually
 costs about 1.50 to 2.50 /cu.ft.
 Use $\$2.00 \times 180 \times 27 = \$9,720$
 add concrete - Pg. 31:
 $180 \times 80 = \frac{14,400}{\$24,120}$
 $24,120 \div 180 =$ say $\$130.00/\text{c.y.}$ to 135.00
 Use $\$10,000$ for shelter

Air Vents
 (12") Drill hole 100' @ 60.00 (incl. setup) = 6,000
 Casing 40' @ 25.00 = 1,000
 Grouting = 3,000
 Prof., O.H. & Escal. incl. $\frac{\$}{10,000}$
 Unit price $\$100.00/\text{ft.}$
 Misc. Connections $\$5,000$

Valve operating structures
 Remove Existing @ $\$1000.00$
 New Construction @ $\$2500.00$

Remove Existing Control Structure $\$10,000$
 Construct New Control Structure

All prices other than concrete from 1975 Means
 Constr. Cost Data.

Misc. Metalwork $\$1.25/\text{lb}$ (Grills)
 Misc. Steel $\$1.00/\text{lb}$

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>LANDSCAPING Lock Dam No. 1</u> <u>cost estimate</u> COMPUTED <u>SOS/FSK</u>	PROJECT <u>L + D No. 1</u> FILE NO <u>800A</u> DATE <u>12-1-71</u> PAGE <u>19</u> OF <u>65</u> PAGE
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NOTE: Landscaping of land adjacent to Lock Dam No. 1 shall consist of planting soil, trees, and shrubs to enhance the aesthetic appearance of the site.

List of Species

Trees

Acer rubrum - red maple

Acer saccharum - sugar maple

Shrubs

Juniperus chinensis pfitzeriana - Pfitzer juniper

Juniperus virginiana globosa - Globe juniper

Taxus cuspidata nana - Dwarf Japanese yew

Sod

Perfect sod

Firmer's

Nursery

31

Quantity	Scientific Name	Height	Caliper Condition	Unit Price	Install.	Transportation	Total Finc.
4	<i>Acer rubrum</i>	18'	5"	BB \$190	124 1/2	19.00	\$333 1/2
4	<i>Acer saccharum</i>	18'	5"	BB 225	146 1/2	22.50	393 1/2

Shrubs

10	<i>Juniperus chinensis p.</i>	4'	-	BB 23	17.00	31	42.00
10	" <i>virginiana</i> , g.	3'	-	BB 27	10.00	2.00	32.00
10	<i>Taxus cuspidata n.</i>	3'	-	BB 24	19.00	2.70	45.70

Sod

600 yds ²	Perfect sod min. free 2" min. 12" max	-	-	2.00	1.60	.20	4.80
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11 Installation 65% of material cost means

Installation 50% of material cost means

31 Transportation 10% of material cost means

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>Landscape costs</u>	PROJECT <u>L&D No. 1</u> <u>FNNA</u>
	COMPUTED <u>SOS/GDK</u>	FILE NO.
	CHECKED <u>JH</u>	DATE <u>12-16-74</u> PAGE <u>20</u> OF <u>65</u>

<u>Scientific Name</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Total Price</u>
Acer Rubrum	4	333 ^m	1332 ✓
Acer Saccharum	4	373 ^{.50}	1574 ✓
Taxus cuspidata	10	32 ^{.70}	320
" virginiana	10	73 ^{.70}	732
TAXUS cuspidata	10	38 ^{.70}	384
500	600 yds ²	3.70	2220
			6262
Contractors Profit & Overhead @ 35%			2191.70
			8453.70
			8905
			4150 \$9,000

ENGINEERING
COMPANY
CHICAGO

Landscaping
COMPUTED GUL CHECKED JL

FILE NO. 0004

DATE 12/12/74 PAGE 21 OF 65 PAG

Figure the Cost of pulling, storing and replacing 5 Elm trees at Lock & Dam No 1.

Say procedure is as follows:

- 1) Cut roots at 10 FT radius to 3 FT depth, say, 3 FT wide trench. Backfill.
- 2) Remove using a Crawler Crane and 2 large front end loaders and a 4 man labor crew for one day per tree
- 3) Maintain and water during construction period say 7 man-hours/wk avg.
- 4) Excavate, Return, Replace, same crew as before, same time.
- 5) Maintain for 6 mo. at 7 man-hr/wk.

1) Cut Roots, say 3x3 trench for $3.14 \times 20 = 60 \text{ FT}^2 \times 3 \times 3 \times 60 \frac{1}{2} = 100 \text{ cu.yds.}$

Use Backhoe & Operator for $\frac{1}{2}$ day due to tight quarters

Labor	$0.90 \times 1.003(\text{OT}) \times 4$	38.55
Equip	25.00×4	<u>100.00</u>
		138.55

Backfill, say 2 hours same as above

<u>69.27</u>
207.82

w/Profit Overhead 35%	280.55
W.C. #	300.00

2) Remove - 5 days - 40 Hrs

Labor

1 Foreman	11.00	11.00
3 Equip op	8.90	26.70
4 Labor	7.70	<u>32.80</u>
		68.50

w/OT 1.003	74.19
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Equipment: 1 Crane 150 Ton	60.00
2 FEL Cat. 992	<u>160.00</u>

Total All	294.19
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w/Profit @ .04 for 40 Hrs	15,886.26	\$16,000
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HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>Cost Estimate</u> <u>Landscapeing</u>	PROJECT <u>Lock & Dam 1</u> FILE NO. <u>800 A</u>
	COMPUTED <u>GJK</u>	CHECKED <u>JK</u>

3) Maintain - 7 man-hours/ak + materials
for \approx 2 years

Labor: $7 \times 2 \times 52 \times 7.70 \times 1.083 = 6070.00$

Equip: Pump, Hoses $728 \times 1.00 = 728.00$

Materials: Marsh, 3000 SF say 4 times in
2 years $12000 \text{ SF} \times 0.15 \quad \frac{1800.00}{8398.00}$

w/ Profit & OH 35% 11607.00
say $\$ 11,700.00$

4) Return - same as #2 $16,000.00$

5) Maintain - 6 mo. $11700/4 \approx \$ 3,000.00$

Total	$\$ 47,000$
4150	$\$ 50,000$

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>Cost Estimate</u> <u>Concrete</u>	PROJECT <u>Lock & Dam No. 1</u> FILE NO. <u>800 A</u>
	COMPUTED <u>JAT</u>	DATE <u>3/3/75</u> PAGE <u>23</u> OF <u>65</u> PAGES CHECKED <u>SMA</u>

The initial estimates for the various schemes (Jan. 17, 1975) were covered in our "Back-Up Computations" pages 1-21 inclusive. These prices, in some cases were rather carefully calculated, and others were based on bidding experience. Since the cost estimates will influence the selection of a scheme, all of the unit prices should be reviewed. Certain of the prices should be calculated in more detail with respect to prevailing working conditions, rates of production and construction methods which may be used. These notes are intended to cover any items, the unit prices of which may be questionable.

1. Consider all concrete work:

Plans 1 & 4 These plans would be scheduled to be accomplished during 5 winter or near winter months. Weather conditions will slow the production rate. The heated shelter will not cover the discharge or intake manifolds, so that production for these features will be slower and costs higher. Because of weather & the work quantity, Plan 4 could be expected to be the most costly and Plan 1 nearly as costly as Plan 4.

Plan 2 Some of this work will be done in winter and most of it in summer and Fall. One might expect these concrete costs to be somewhat less than similar work for Plan 1.

Plan 3 Since navigation would be halted, all work could be done in spring, summer and fall for the cheapest price.

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>Cost Estimate</u> <u>Concrete</u>	PROJECT <u>Lock & Dam No. 1</u>
	COMPUTED <u>JAT</u>	CHECKED <u>SMA</u>
		FILE NO <u>800A</u> DATE <u>3/3/75</u> PAGE <u>24</u> OF <u>65</u>

1. Concrete Work, Cont'd.

Assume that a typical concrete placement crew will consist of the following

		Shifts <u>2@10hr</u>	Shift: <u>K@10</u>
Labor	rate	amt	
1 Foreman	10.35	10.35	
1 Crane Operator 50%	9.00	9.00	
1 Pumpcrete Operator	7.75	7.75	
1 Compressor Operator	7.75	7.75	
2 Vibrator men	7.75	15.50	
1 Form Checker	8.00	8.00	
1 Finisher	8.00	8.00	
3 Laborers	7.00	<u>21.00</u>	
Subtotal		<u>87.35</u>	<u>87.35</u>
* Shift diff. & Overtime allowance 22.5%:		<u>19.65</u>	<u>17% 14.6:</u>
Total Labor	\$	<u>107.00</u>	<u>102.0.</u>

Equipment

(1ST) 1 Truck Crane 50%	13.00	6.50	see page ①
1 Compressor	9.00	9.00	
1 Pumpcrete	16.00	16.00	
2 Vibrators	0.50	1.00	

Misc. Tools

Total Equipment \$ 35.00 /hour
Cost of crew, labor & equipment \$ 142.00 or \$ 137.00

Materials

Concrete, ready mix - delivered use \$ 27.00 /cu.yd.
Reinforcing steel — use \$ 0.25 /lb. (direct cost with mark-up total bid would be \$ 0.39 /lb. — including ironworker's time).

Note : Concrete work will be divided into categories with varying rates of production and quantities of reinforcing steel.

* Assume 2@10 hr. shifts/day, 6 days/wk

$$\frac{\text{hrs. pd}}{\text{hrs. Worked}} = \frac{[(40 \times 1) + (20 \times 1.5)]}{[(40 \times 1.1) + (20 \times 1.5 \times 1.1)]} = 1.225$$

$$\text{and } \frac{60 + 60}{(40 + 30)} = 1.17 \text{ for } 1@10 \text{ hrs./day, 6 days/wk.}$$

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>Cost Estimate</u> <u>Concrete</u>	PROJECT <u>Lock & Dam No. 1</u>
	COMPUTED <u>JAT</u>	FILE NO. <u>800 A</u>
	CHECKED <u>ENR</u>	DATE <u>3/1/75</u> PAGE <u>25</u> OF <u>65</u> PAGES

1. Concrete Work, Cont'd

We will figure on 10 hour shifts, 6 days per week. Double shift to be used where schedule is tight. We have used single shift rates for equipment, even though the double shift rate is somewhat cheaper. Under average conditions, the above crew should place from 5 to 7 cu.yds of concrete per hour, while actually placing concrete.

From Page 23

Cost for double shift crew = \$142.00/hr

Cost for single shift crew = \$137.00/hr

(Composite for Plan 2 - about \$139.00/hr)

We will assume the following average production rates per crew hour:

① (page 24). Truck Crane, 15 Ton, price from C.E.C.R.G. (Grove TM 15 Ton - \$14.49/hr on 20 hour day.)

② (Page 24). Concrete price \$27.00/c.y. for 3000 psi concrete. ENR March 6, 1975 price \$23.50 + 15% heat and waste = \$27.00/c.y.

These averages have been adjusted for the various categories of concrete, job conditions, etc:

	cubic yards per hour			
	P	L	A	N
New Manifolds & Conduits	4.25	4.5	5.3	4.0
Slots	2.0	2.0	2.0	.1.7
Fill Gate Slots & Conduit	8.0	10.0	10.0	7.5
Walls	6.0	8.0	10.0	5.5
Slabs & Footings	8.0	10.0	10.0	7.5
Slurry Trench	8.0	8.0	8.0	7.5
Fill Shear Keys	6.0	8.0	8.0	5.5
Bridge & Control House	5.0	7.0	7.0	4.5
Misc.	2.0	2.0	2.0	1.5

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HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>Cost Estimate</u> <u>Concrete</u>	PROJECT <u>Lock & Dam No. 1</u>
	COMPUTED <u>SMA</u>	FILE NO. <u>832 A</u>
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Tabulation of concrete type volumes.

	PLAN NO.	1	2	3	4
1. New Manifolds + Conduits					
Discharge man. downstr. of land lock	900	900	900	900	
" " " river "	900	900	900	1,350	
Intake manifold:					
Upper guide wall	800	800	800	800	
Land wall	60	60	60	60	
Intermediate wall	1,100	1,100	1,100	1,650	
River wall	0	0	0	0	1,100
Discharge manifold:					
Lower guide wall	1,300	1,300	1,300	1,300	
Intermediate wall extension	2,500	2,500	2,500	4,150	
River wall extension	0	0	0	0	3,000
Others:					
Rebuilt ports for land wall	130	130	130	130	130
New ports for intermediate wall	110	110	110	110	110
Total	7,800	7,800	7,800	15,110	
2. Slots					
New bulkhd. gate slot for land wall	35	35	35	35	
" " " " interm. "	35	35	35	70	
" " " " river "	0	0	0	0	35
Total	70	70	70	140	

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HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>Cost Estimate</u> <u>Concrete</u> COMPUTED <u>SMA</u>	PROJECT <u>Lock + Dam No. 1</u> FILE NO. <u>800 A</u> DATE <u>2/6/75 PAGE 22</u> or <u>65</u> PAGES
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PLAN NO.

, 1 , 2 , 3 , 4 .

G. Fill Gate Slots & Conduit

Lowered conduit for land wall	400	400	400	400
Fill gate slot " "	40	40	40	40
Existing conduit " "	200	200	200	200
Depress cond. root " "	300	300	300	300
Fill exist. gate slot " "	300	300	300	300
Lowered conduit for intermediate wall	400	400	400	800
New fill. gate slot " "	40	40	40	80
Existing conduit " "	200	200	200	200
Depress cond. root " "	300	300	300	600
Close old ports " "	40	40	40	80
Fill exist. gate slots " "	300	300	300	600
Lowered conduit for river wall	0	0	0	400
Fill gate slot " "	0	0	0	40
Existing conduit " "	0	0	0	200
Depress cond. root " "	0	0	0	300
Conduit ports " "	0	0	0	130
Fill exist. gate slots " "	0	0	0	300
Total	2,520	2,520	2,520	4,970

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HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>Cost Estimate</u> <u>Concrete</u> COMPUTED <u>SMA</u>	PROJECT <u>Lock + Dam No. 1</u> FILE NO. <u>B20 A</u> DATE <u>7/75</u> PAGE <u>28</u> OF <u>65</u>
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PLAN NO.

, 1 , 2 , 3 . 4

4. Walls

River guide wall monolith	0	0	0	370
Total	0	0	0	370

5. Slabs + Footings

Upstream apron slab (2' thick)	1,400	1,400	1,400	1,400
Land wall footings	14	14	14	14
Repair of concrete surfaces	900	900	900	900
Total	2,314	2,314	2,314	2,314

6. Slurry trench

Discharge manifold slurry trench	180	180	180	260
Total	180	180	180	260

7. Fill shear Keys

Intermediate wall (reinforced)	26	26	26	26
River wall	0	26	0	26
Total	26	52	26	52

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HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>Cost Estimate</u> <u>Concrete</u>	COMPUTED → M A	CHECKED JW	PROJECT Lock + Dam No. 1 FILE NO. 800 A DATE 3/7/75 PAGE 29 OF 65 PAGES
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PLAN NO.

1 , 2 , 3 , 4

8. Bridge & Control House

Bridge & elevator	220	220	220	220
Control house	400	400	400	230
Total	620	620	620	450

9. Miscellaneous

Dead men	20	20	20	20
Land wall cribbing	20	20	20	20
Cable trenches for land wall	7	7	7	7
Mooring bits " " "	140	140	140	140
Cable trenches for interm. wall	7	7	7	14
" " " river "	0	0	0	7
Fill inclined shaft in dam	15	15	15	15
Total	209	209	209	223

TOTAL OF ALL CONCRETE	13,739	13,765	13,559	23,889
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HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>Cost Estimate</u> <u>Concrete</u> COMPUTED <u>SMA</u>	PROJECT <u>Lock & Dam No. 1</u> FILE NO. <u>800 A</u> DATE <u>3/7/75</u> PAGE <u>30</u> OF <u>65</u> PAGES
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Computation of Average Productivity

WORK TYPE		PLAN NO.			
		1	2	3	4
1. New Manifolds & Conduits	yd ³ /hr.	4.25	4.5	5.3	4.0
	yd ³	7,800	7,800	7,800	15,110
	crew hours	1,835	1,733	1,472	3,777
2. Slots	yd ³ /hr.	2.0	2.0	2.0	1.7
	yd ³	70	70	70	140
	crew hours	35	35	35	82
3. Fill Gate Slots & Conduit	yd ³ /hr.	8.0	10.0	10.0	7.5
	yd ³	2,520	2,520	2,520	4,970
	crew hours	315	252	252	663
4. Walls	yd ³ /hr.	6.0	8.0	10.0	5.5
	yd ³	0	0	0	370
	crew hours	0	0	0	67
5. Slabs & Footings	yd ³ /hr.	8.0	10.0	10.0	7.5
	yd ³	2,314	2,314	2,314	2,314
	crew hours	289	231	231	309
6. Slurry Trench	yd ³ /hr.	8.0	8.0	8.0	7.5
	yd ³	180	180	180	260
	crew hours	22	22	22	35
7. Fill Shear Keys	yd ³ /hr.	6.0	8.0	8.0	4.5
	yd ³	26	52	26	52
	crew hours	4	7	3	12

FOR USE ON U.S. GOVERNMENT WORK ONLY

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>Cost Estimate</u> <u>Concrete</u> COMPUTED <u>SMA</u>	PROJECT <u>Lock & Dam No. 1</u> FILE NO <u>B00 A</u> DATE <u>3/7/75</u> PAGE <u>31</u> or <u>65</u> PAGES
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WORK TYPE		PLAN N.O.			
		1	2	3	4
8. Bridge & Control House					
yd ³ /hr		50	7.0	7.0	4.5
yd ³		620	620	620	450
crew hours		124	89	89	100
9. Miscellaneous					
yd ³ /hr.		2.0	2.0	2.0	1.5
yd ³		209	209	209	223
crew hours		105	105	105	147
TOTAL CREW HOURS		2,727	2,474	2,209	5,194
TOTAL CONCRETE (yd ³)		13,739	13,765	13,557	23,889
AVG. PRODUCTIVITY(yd ³ /crewhour)		5.03	5.56	6.13	4.57
		5.0	5.6	6.1	4.6

These weighted averages are reasonable

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>Cost Estimate</u> <u>Concrete</u>	PROJECT <u>Lock & Dam No. 1</u>
	COMPUTED <u>JAT</u>	FILE NO. <u>800 A</u>
	CHECKED <u>S.M.H.</u>	DATE <u>3/7/75</u> PAGE <u>32</u> OF <u>65</u> PAGES

Concrete Work, Cont'd

Description	① cu.yds. placed per hr.	② Concrete at site per cu.yd.	③ Place, Vibrated	④ ReSteel Finish	⑤ @ \$0.25 per lb.	⑥ Total Direct cost	⑦ Price per cu.yd. w/ Profit & Overhead (rounded)
			Place, Vibrated	ReSteel Finish	@ \$0.25 per lb.	Total Direct cost	Price per cu.yd. w/ Profit & Overhead (rounded)
New Manifolds & Conduits	4.25	27.00	142.00	85.00	80.41	125.00	
Gate Slots	2.0	27.00	142.00	40.00	118.00	185.00	
Fill Gate Slots & Conduits	8.0	27.00	142.00	60.00	52.25	80.00	
Walls	6.0	27.00	142.00	45.00	58.16	90.00	
Slabs & Footings	8.0	27.00	142.00	120.00	59.75	95.00	
In Slurry Trench	8.0	27.00	142.00	60.00	52.25	80.00	
Fill Shear Keys	6.0	27.00	142.00	150.00	75.66	115.00	
Bridge & Control House	5.0	27.00	142.00	220.00	99.40	155.00	
Misc	2.0	27.00	142.00	80.00	138.00	215.00	

Plan 2 About 13,770 cu.yds. of concrete (30% double shift
and 70% single shift.)

New Manifolds & Conduits	4.5	27.00	139.00	90.00	77.08	120.00
Gate Slots	2.0	27.00	139.00	40.00	116.50	180.00
Fill Gate Slots & Conduits	10.0	27.00	139.00	75.00	68.40	75.00
Walls	8.0	27.00	139.00	60.00	51.87	80.00
Slabs & Footings	10.0	27.00	139.00	150.00	55.90	85.00
In Slurry Trench	8.0	27.00	139.00	60.00	51.87	80.00
Fill Shear Keys	8.0	27.00	139.00	200.00	69.37	110.00
Bridge & Control House	7.0	27.00	139.00	308.00	90.85	140.00
Misc.	2.0	27.00	139.00	80.00	136.50	210.00

$$\textcircled{6} = [(\textcircled{1} \times \textcircled{2}) + \textcircled{3} + \textcircled{4}] \div \textcircled{1}$$

$$\textcircled{7} = 1.35 \times 1.15 \times \textcircled{6}$$

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>Cost Estimate</u> <u>Concrete</u>	PROJECT <u>Lock & Dam No. 1</u> <u>800 A</u>
COMPUTED JAT	CHECKED SMA	FILE NO. DATE 3/7/75 PAGE 33 OF 65 PAGE

*Concrete Work, Cont'd**Plan 3 About 13,560 cu.yds. of concrete (all single shift)*

	cu.yds placed per hr	Concrete at site per cu.yd.	Place, Vibrate and Finish	ReSteel @ \$0.25 per lb.	Total Direct Cost	Price pc. cu.yd. w/proj: q.g.h. (escal/ rounde)
New Manifolds & Conduits	5.3	27.00	137.00	106.00	72.84	115.00
Gate Slots	2.0	27.00	137.00	40.00	115.50	180.00
Fill Gate Slots & Conduits	10.0	27.00	137.00	75.00	48.20	75.00
Walls	10.0	27.00	137.00	75.00	48.20	75.00
Slabs & Footings	10.0	27.00	137.00	150.00	55.70	85.00
In Slurry Trench	8.0	27.00	137.00	60.00	51.62	80.00
Fill Shear Keys	8.0	27.00	137.00	200.00	69.12	105.00
Bridge & Control House	7.0	27.00	137.00	308.00	90.57	140.00
Misc.	2.0	27.00	137.00	80.00	135.50	210.00

Plan 4 About 23,890 cu.yds. of concrete (all double shift)

	cu.yds placed per hr	Concrete at site per cu.yd.	Place, Vibrate and Finish	ReSteel @ \$0.25 per lb.	Total Direct Cost	Price pc. cu.yd. w/proj: q.g.h. (escal/ rounde)
New Manifolds & Conduits	4.0	27.00	142.00	80.00	82.50	130.00
Gate Slots	1.7	27.00	142.00	34.00	130.52	200.00
Fill Gate Slots & Conduits	7.5	27.00	142.00	56.00	53.40	85.00
Walls	5.5	27.00	142.00	41.00	60.27	95.00
Slabs & Footings	7.5	27.00	142.00	113.00	61.00	95.00
In Slurry Trench	7.5	27.00	142.00	56.00	53.40	85.00
Fill Shear Keys	5.5	27.00	142.00	138.00	77.90	120.00
Bridge & Control House	4.5	27.00	142.00	198.00	102.55	160.00
Misc.	1.5	27.00	142.00	60.00	161.66	250.00

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>Cost Estimate</u> <u>Sand Fill in Main Dam</u>	PROJECT <u>Lock & Dam No. 1</u>
	COMPUTED <u>JAT</u>	CHECKED <u>SMA</u>
		FILE NO. <u>800 A</u> DATE <u>3/6/75</u> PAGE <u>84</u> OF <u>65</u> PAGES

Cost of Pumping Sand Into Main Dam Cavity.

(Originally this was planned as lean concrete)

- a) Work consists of clearing each 6"φ relief hole by hand excavation inside of dam, then place wire mesh against opening and fill ($2 \pm$ cu. ft.) of gravel to provide drainage after sand is pumped in.

$$2 \text{ per } 16' \text{ bay} = 72 \text{ holes}$$

Assume 6 holes per 8 hr day, Total hrs = 96
use 100 hrs

labor

Foreman	8.40
3 laborers	21.00
	<u>29.40</u>

$$\times 8 = 235.20$$

Equipment

Wheel barrows, etc. 2.00 × 8 = 16.00

Mat'l

Gravel	4.00
125 cu' Screen $\frac{1}{2}$ " mesh(0.35)	4.72
Mat'l	<u>8.72</u>
Total = Per day	<u>8.72</u>
$(259.92 \div 6) \times 72 = \$3,119$	direct cost

- b) Fill in by pumping 5000 cu.yds. of mixture of sand and water, use pump similar to pump crane capable of 25 cu.yds/hr. With delays figure job can be done at average of 15 cu.yds/hr or say 320 hours. Assume sand can be dumped onto draft tube deck by truck @ \$ 6.00 / cu.yd. Small (Bobcat) dozer will move material to small mixer where sand is mixed with water pumped from tailrace. Mixture then pumped into dam through 6 inch pipe.

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>Cost Estimate</u> <u>Sand Fill in Main Dam</u>	PROJECT <u>Lock & Dam No. 1</u> FILE NO <u>500 A</u>
COMPUTED <u>JAT</u>	CHECKED <u>E.M.A.</u>	DATE <u>3/6/75</u> PAGE <u>35</u> OF <u>65</u>

Cost of Pumping Sand into Main Dam CavityCostLabor

Foreman	12.50
Dozer (Bobcat) Oper.	8.70
Water Pump Oper	7.75
Mixer Oper	7.75
Pump Oper	7.75
4 Laborers	<u>28.00</u>
Labor /hr	<u>70.45</u>

Equipment

'Dozer	5.00
Pumps & mixer	<u>30.00</u>
Equip/hr	<u>35.00</u>

Materials

Sand 15 cu yd @ 6.00	90.00
Pipe rental	<u>3.00</u>
Mat'l/hr	<u>93.00</u>

Total per hour 198.45

$$[(198.45 \times 320) + 3119] \times 1.35 \times 1.15 = \$103,432$$

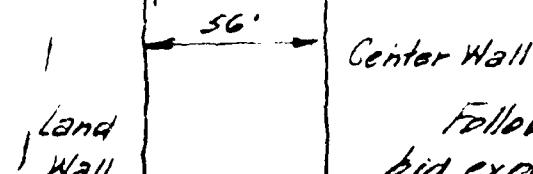
Per cu.yd. (\div by 5,000) = $\$20.68$

Say $\$21.00$ /cu.yd.

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>Cost Estimate</u> <u>Rock Anchors</u>	PROJECT <u>Lock & Dam No. 1</u> FILE NO. <u>800 A</u> DATE <u>3/6/73</u> PAGE <u>36</u> OF <u>65</u> PAGES
COMPUTED <u>JAT</u>	CHECKED <u>SMA</u>	

Cost of Rock Anchors for Stabilization of Land Wall

guide Drill Rig



Following prices are either from
bid experience or worked out.

1) AH 1 (1 3/8" single anchors)

2) Setup drill - 6 hrs

Labor

1 Driller	8.00	8.00
2 Helpers	7.00	<u>14.00</u>

$$22.00/\text{hr} \times 6 = 132.00$$

Place guide and support
for drill rig. L.S.

$$\frac{100.00}{232.00}$$

$$232 \times 1.35 \times 1.15 = \$ 360.18$$

To allow for moving drill to
center wall and removal of guides
and supports, use per setup \$400.00

b) Drilling Holes

Drill & Crew costs about \$30.00/hr
use 5 ft/hr for drilling

$$\frac{30 \times 1.35 \times 1.15}{5} = \$ 10.00/\text{lin.ft.}$$

c) for Core Recovery use \$ 10.00 /lin.ft.

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>Cost Estimate</u> <u>Rock Anchors</u>	PROJECT <u>Lock & Dam No 1</u> FILE NO <u>800 A</u> DATE <u>3/6/75</u> PAGE <u>37</u> OF <u>65</u> PAGES
COMPUTED <u>JAT</u>	CHECKED <u>SMA</u>	

Cost of Rock Anchors, Contd.

d) Place Grout & tension Anchor Bars
Figure total time per Anchor @ 8 hrs

Labor

Foreman	10.50
Welder 50%	4.50
Grout Pump Oper	8.00
3 Laborers	21.00
	<u>\$44.00/hr</u>

Equipment

Grout Pump, Welding	15.00
Equip. & Misc.	15.00
Labor & Equip	8 x 59 = 472

Material

90' of bar with fittings	160.00
Grout 4.4 cu.ft. @ 2.00 (587) \rightarrow	10.00
Material/hole	<u>170.00</u>
	<u>170</u>
	<u>642</u>

$$\frac{642 \times 1.35 \times 1.15}{90} = 11.07$$

Use \$11.00 / lin.ft.

Alt. 2 1 1/4" Double Anchors

a) Set up - same as Alt. 1 = \$400.00

b) Drilling Hole 4"

Production might be slightly slower than Alt. 1.

use \$12.00 /lin.ft.

c) Core Recovery, Same as Alt. 1 \$10.00 /lin.ft.

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>Cost Estimate</u> <u>Rock Anchors</u>	PROJECT <u>Lock & Dam No. 1</u>
COMPUTED <u>JAT</u>	CHECKED <u>SMA</u>	FILE NO <u>800 A</u>
		DATE <u>4/9/72</u> PAGE <u>38</u> OF <u>65</u> PAGES

Cost of Rock Anchors Cont'd.
Alt. 2, Cont'd (1 1/2" Double Anchors)

d. Place, Grout & Tension Anchor Bars
Figure time for 2 @ 95' bars @ 10 hrs

Labor (Alt. 1) $44.00 \times 10 = 440.00$

Equipment $15.00 \times 10 = 150.00$

Bars

$95 \times 2 \times 4.172 @ \$0.35 = 277.43$

Grout 8.3 cu.ft. @ \$2.00 $\frac{16.60}{294.03} \approx \frac{300.00}{890.00}$

Total

$\frac{890 \times 1.35 \times 1.15}{95} = \14.54

Use \$15.00/lm.ft.

Alt. 3 1 1/4" Triple Anchors

a) Set up - same as Alt. 1 & Alt. 2 \$400.00

b) Drill 5" hole

Use 3'/hr. same hourly cost

as Alt. 1

$\frac{30 \times 1.35 \times 1.15}{3} = \15.52 use \$16.00/lm.

c) Core Recovery use \$10.00/lm.

d) Place, Grout & Tension Anchor Bars

Figure 3 @ 100 bars @ 14 hrs

Labor (Alt. 1 & 2) $44.00 \times 14 = 616.00$

Equipment $15.00 \times 14 = 210.00$

Bars $3 \times 100 \times 4.172 \times \$0.35 = 438.00$

Grout 13.66 cu.ft. @ \$2.00 $\frac{27.32}{\$465.32} \frac{465.00}{\$1291.00}$

$\frac{1291 \times 1.35 \times 1.15}{100} = \20.00

Use \$20.00/lm.ft.

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>Cost Estimate</u> <u>Shear Keys</u>	PROJECT <u>Lock & Dam No. 1</u> <u>800 A</u>
	COMPUTED <u>JAT</u>	CHECKED <u>SMA</u>
		DATE <u>3/25/75</u> PAGE <u>39</u> OF <u>65</u> PAGES

Compute costs of Shear Keys

a) Drilling, Vertical Holes - use rotary drill.

Costs	While Drilling (equip. Depr. & Op.)	While Setting Up (Equip. Depr.)
-------	--	------------------------------------

Labor

1 Foreman	10.35	10.35
1 Drill Operator	9.00	9.00
2 Helpers	7.00	7.00
1 Pump operator	7.75	7.75
Subtotal	34.10	34.10
17% [±] S.D. & O.T.	5.90	5.90
Labor per Hr.	40.00	40.00

Equipment

1 Drill	35.00	15.00
1 Pump	5.00	1.00
Bit cost	5.00	-
Equipment/hr	45.00	16.00

Total Per Hr

W/35% Profit & O.H. +	85.00	56.00
15% [±] Escal.	47.00	31.00
Total/Hr	\$132.00	\$87.00

Production 1 ft/hr avg. \$132.00/ft.
use \$140.00/lin.ft.

Setup time incl. move in &
move out, average

3 hrs

Cost of move & set-up

\$84 \$250.00

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>Cost Estimate</u> <u>Shear Keys</u>	PROJECT <u>Lock & Dam No. 1</u> FILE NO <u>800A</u> DATE <u>3/25/75</u> PAGE <u>40</u> OF <u>65</u>
COMPUTED <u>JAT</u> CHECKED <u>SMR</u>		

Shear Keys, Contd.

b) Drilling horizontal holes use - jackhammers
 The drilling will be done from moveable scaffolding.
 Hole pattern will be drilled such that inner core
 of concrete can be removed with out blasting.
 This will involve considerable drilling. The opening
 desired should be equivalent of 2'Ø hole or 2'
 Could be square of say 22". Figure cost
 one opening which will require about
 $6' \times 11' \times 4 = 264 \text{ lin.ft. to drill}$

Assume avg. production @ 1/2' / minute; Total drill
 time 8.8 hrs. At 75% efficiency use 12 hrs.
 for drill time only.

Scaffolding would be moveable and required for
 other operations as well, such as wall clean up,
 shotcrete, etc. Prices for these items are
 considered high enough to includes scaffolding
 which would cost say about \$2,500.00 per
 wall surface, or about \$10,000.00 for the job, on
 a rental basis.

Drill one opening & remove material

$$\text{Labor } [(1.7 \times 1.7 \times 6) : 27] = \text{about } 0.7 \text{ cu.yd.}$$

Foreman	9.30
1 driller	7.75
1 helper	7.00
1 compr. oper	7.75
Subtotal	<u>31.80</u>
17% SD & OT	<u>5.40</u>

$$37.20 \times 12 = 446.40$$

Equipment	10.00
remove 0.7 cu.yd @ 5.00	<u>3.50</u>

$$446.40 + 10.00 + 3.50 = \$569.90$$

W/35% Profit & Overhead & 15% Escalation \$883/opening

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>Cost Estimate</u> <u>Shear Keys - Vents</u>	PROJECT <u>Lock & Dam No. 1</u> FILE NO. <u>800 A</u> DATE <u>3/25/75</u> PAGE <u>41</u> OF <u>65</u> PAGES
COMPUTED <u>JAT</u>	CHECKED <u>SMA</u>	

Shear keys

Cost of one horizontal hole = \$ 883.00
(this does not include scaffolding)

We have 16 holes.

Assume 30% of scaffolding rent is charged to these holes

$$\frac{.30 \times 10,000}{16} = 187.50$$

Total / hole \$ 1070.50

Cost per hole, use \$ 1200.00

or \$ 200.00 / lin. ft. for excavation

Enlarge Vent system

Set up over hole - Page 38 of 63 \$ 250.00
Drill 3'-0" dia hole
Assuming .85 ' / hr - Page 38 of 63 \$ 165.00

Pipe @ 75¢ / lb

Misc. Connections, etc use 10% of pipe cost
for excavation and backfill use \$ 10.00 / c.y.

ESTIMATE

HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

Project Rehabilitation of Lock and Dam No. 1 Date NOV. 1975 Page 42 of 65 Pages
 Discharge Manifolds with Stilling
 Structure Basin East of River Wall Estimated by JAT/VT Checked by VT

Item No.	ITEM	Quantity	Unit Price	Amount
	<u>PLAN No. 4A</u>			\$ 0.00
	Removal of Slab and Apron; Pg. 5 of 20 of Estimate			72400
	Lower Guide Wall; Pg. 5 of 20 of Estimate (Unit price of concrete revised from Plan No. 1 to Plan No. 4)			249250
	Laterals Downstream of Landward Lock; Pg. 6 of 20 of Estimate (Unit price of concrete revised from Plan No. 1 to Plan No. 4)			206935
	Intermediate Wall Extension; Pg. 6 of 20 of Estimate (Unit price of concrete revised from Plan No. 1 to Plan No. 4)			310900
	Laterals Downstream of Riverward Lock; Pg. 7 of 20 of Estimate (Unit price of concrete revised from Plan No. 1 to Plan No. 4)			215120
	Subtotal			1054605
	<u>Stilling Basin</u>			
	Excavation, Alluvium	2,000 c.y.	65.00	6000
	Remove Concrete Slab	130 c.y.	65.00	8450
	Gravel Filter	150 c.y.	13.50	2025
	Concrete Slabs	175 c.y.	95.00	16625
	Concrete Walls	360 c.y.	130.00	46800
	Forms, Straight	9,000 sq.ft.	3.00	27000
	Riprap	200 c.y.	16.50	3300
	Subtotal Stilling Basin			110200
	<u>Discharge channel</u>			
	Excavation, Alluvium	7,500 c.y.	3.00	22500
	<u>Additional Cofferdam</u>			
	Steel Sheet Piling	50 tons	600.00	30000
	Cell Fill	500 c.y.	13.50	6750
	Rock Protection, Flow Side	100 c.y.	22.50	2250
	Subtotal Additional Cofferdam			38800
	Subtotal Discharge Manifolds with Stilling Basin			1226105

ESTIMATE

HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

Project Rehabilitation of Lock and Dam No. 1 Date Nov. 1975 Page 43 of 65 Pages
Discharge Manifolds with Bent Discharge
Structure East of River Wall Estimated by JAT/VT Checked by VT

Item No.	ITEM	Quantity	Unit Price	Amount
	<u>PLAN NO. 4B</u>			\$ U.S.
	Removal of Slab and Apron; Pg. 5 of 20 of Estimate			72 800
	Lower Guide Wall; Pg. 5 of 20 of Estimate (Unit price of concrete revised from Plan No. 1 to Plan No. 4)			249 250
	Laterals Downstream of Landward Lock; Pg. 6 of 20 of Estimate (Unit price of concrete revised from Plan No. 1 to Plan No. 4)			206 935
	Intermediate Wall Extension; Pg. 6 of 20 of Estimate (Unit price of concrete revised from Plan No. 1 to Plan No. 4)			310 900
	Laterals Downstream of Riverward Lock; Pg. 7 of 20 of Estimate (Unit price of concrete revised from Plan No. 1 to Plan No. 4)			215 120
	Subtotal			1 059 605
	<u>Discharge Structure East of River Wall</u>			
	Excavation, Alluvium	1,500 c.y.	3.00	4 500
	Remove Concrete Slab	130 c.y.	65.00	8 450
	Gravel Filter	150 c.y.	13.50	2 025
	Concrete Slabs	350 c.y.	95.00	33 250
	Concrete Walls	800 c.y.	130.00	104 000
	Forms, Straight	11,000 sq.ft.	3.00	33 000
	Forms, Curved	200 sq.ft.	6.00	1 200
	Riprap	250 c.y.	16.50	4 125
	Subtotal Discharge Structure			190 550
	<u>Discharge Channel</u>			
	Excavation, Alluvium	6,200 c.y.	3.00	18 600
	<u>Additional Cofferdam</u>			
	Steel Sheet Piling	50 tons	600.00	30 000
	Cell Fill	500 c.y.	13.50	6 750
	Rock Protection, Flow Side	100 c.y.	20.50	2 050
	Subtotal Additional Cofferdam			38 800
	<u>Total Discharge Manifolds with Bent Discharge Structure East of River Wall</u>			1 302 555

ESTIMATE

HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

Project Rehabilitation of Lock and Dam No. 1 Date Nov. 1975 Page 44 of 65 Pages
Structure Reconstruction of Extension of River Wall Estimated by SAT/VT Checked by VT

**HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS**

Project REHABILITATION LOCK AND DAM #1 Date MARCH 1975 Page 1
Structure REPAIR OF CONCRETE SURFACES Estimated by RPH

**MEETING COMPANY
BAGO, ILLINOIS
ESTIMATE**

Page 45 of 65

Printed 10/27 Page 43 of 63 Pages

Entered by PPT Checked by

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>Feasibility of Lock Winter Rehabilitation</u> COMPUTED <u>SMH</u>	PROJECT <u>Lock & Dam No. 1</u> FILE NO <u>822 A</u> DATE <u>3/24/75</u> PAGE <u>46 or 65</u>
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The lock rehabilitation, for any of the four plans considered, involves work in five primary locations:

1. Lock interior - floor and walls
2. Culvert interiors
3. Ends of locks - miter gates, valves
4. Upstream of lock - intake manifold
5. Downstream of lock - discharge manifold

The last three of these areas involve work which can, using the assumed crew sizes shown in the computations, be easily accomplished during the 5 month winter construction period required by plans 1 and 4. The first two locations appear to require close supervision and planning in order to meet the desired schedule. In considering the feasibility of this winter work, the following sequences of events were arrived at as a means of completing the required work in the allotted time.

1. Lock Interior

clean surfaces

inspect concrete and repair lock floor
bore and fill grout holes

drill orifice holes

removal wall vertical face concrete

remove concrete for new orifices; clean up loose concrete

install req'd wall reinforcement & shotcrete

reinforce, form, & pour new conduit orifices & plug old orifices

strip forms & clean up

This sequence of events would be accomplished with crew sizes chosen so that each major activity would proceed at the same rate. In this way, a

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>Feasibility of</u> <u>LOCK Winter Rehabilitation</u> COMPUTED <u>SMA</u>	PROJECT <u>Lock & Dam No. 1</u> FILE NO. <u>822 A</u> DATE <u>3/24/75</u> PAGE <u>47 or 65</u>
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steady flow of work could be maintained, with each task following the one preceding it around the lock. A consequence of this sort of scheduling is that the demand for manpower would be less variable. The manpower curve computed on the basis of the rough CPM diagram represents a pessimistic picture of actual fluctuations to be expected, since it does not consider the refined flow of activities described above. However, since some levelling of peaks in the manpower curve has already occurred in the computations (through the use of 'avg. weekly crew sizes', which consider a one-day crew of 6 equivalent to a one-week crew of 1), the manpower curve will be presented unmodified.

2. Culvert interiors:

- drill + fill grout holes; drill orifice holes
- cut break lines in culvert ceiling
- remove culvert ceiling concrete
- drill enlarged vent openings
- install + grout vent pipes
- install ceiling reinforcement
- slip form + pour ceiling concrete
- Clean up

While this work occurs, the culvert lowering and valve installation activities at the upstream culvert end proceed. It should be noted that some or all of the discharge conduits leading from the main culverts to the lock interiors might also be made working from the interior of the culverts, rather than from the lock interior itself. The suggested activity sequence should allow

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>Feasibility of Lock</u> <u>Winter Rehabilitation</u> COMPUTED <u>M.A.</u>	PROJECT _____ FILE NO. _____ DATE <u>2/27/65</u> PAGE <u>48</u> OF <u>65</u>
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*for plan no. 1

a smooth flow of work in the culvert interior, avoiding the congestion the confined working area implies. Note that grouting occurs only in the intermediate wall culverts. This means that the lowering of the culvert ceiling in the land wall could proceed while grouting is in progress in the intermediate wall culvert or culverts.

Finally, consideration of the extent of rehabilitation must be made. Only the plans (1 and 4) involving major winter work are considered here, since the other plans are not subject to the rigid time constraints. If plans 1 and/or 4 can be accomplished, then certainly plans 2 and 3 are feasible.

The event sequencing described above, in view of the computed manpower curve for the project, implies the feasibility of plan 1, in which the landward lock only is rehabilitated, during the winter. The question of whether both locks could be repaired at this time remains.

If plan 4 is implemented, no increased congestion is foreseen in the lock interior work areas, since the riverward lock activities would be physically separate from those landward lock. The approximate doubling in overall manpower and equipment usage levels could, however, cause congestion in the staging areas.

Notes: 1. Activity durations are based on the assumption of two 10-hour shifts per day, six days per week.

2. No adjustment was applied to outdoor work to reflect the slower pace of construction in cold weather. Since this work is not critical

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Notes (cont.):

to the overall project completion deadline, this approach should not affect the feasibility of the project.

3. In order to accomplish small activities not broken down on the CPM (such as installation of compressed air lines for the dewatering system), the manpower curve projected for this project should be inflated by 10%. This addition will also subsume the extra man hours needed to accomplish the outdoor work under winter conditions.

Comments

Plan No. 1: As indicated by the manpower curve, the peak manpower demand should be about 125 men, working upstream from the locks, downstream, and in the lock interiors. It is felt that this number will not overtax the capacity of the staging and project access areas; this plan is therefore considered feasible. Since no mechanical rehabilitation of the riverward lock is included under this plan, any delay in completing the winter construction will delay use of the lock the following spring. Scheduling is tight, but work should proceed smoothly if scheduled as suggested above.

Plan No. 2: Peak manpower demand should be less than that for Plan No. 1, due to the longer period of lock rehabilitation and the higher worker productivity to be expected in the summer.

This plan appears to present the least possibility of impairment to river traffic. Two possible problems require consideration. First, since

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Plan No. 2 (cont) - summer lock interior work proceeds without a cofferdam, the ability of the new lock bulkheads to keep the landward lock dry for long periods of time must be assured. Secondly, leakage of water from the adjacent riverward lock into the landward lock must be minimized. This could present a problem since grouting under the intermediate wall is not scheduled to begin until the summer.

Plan No. 3. The extended duration allowed the contractor for lock interior and exterior work under this plan makes it the easiest one for him to complete according to schedule. Manpower peak requirements should be even less than those for plan no. 2. Unlike plan no. 2, no mechanical improvements are scheduled for the riverward lock, making it more difficult to use that lock should future repairs to the landward lock be required. The year long closure to river traffic is, of course, the primary disadvantage.

Plan No. 4- With some exceptions, this plan represents a stereo duplication of plan no. 1. Little or no extra congestion is expected in the lock areas, since the workers in the two locks will be physically separate. Peak manpower requirements should be less than double those of plan no. 1, since not all work is duplicated (i.e. both plans require grouting through both intermediate wall culverts), and since such a situation would encourage development of specialized crews to do one major task (such as culvert work) throughout the project, thereby

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Plan N. 4 (cont.) - increasing overall worker productivity.

All Plans - There were two alternatives suggested concerning protection of the guidewalls from snubbing impact. The more expensive of the two involves removal of 1.3 feet of wall face concrete, installation of reinforcement and embedment of wall armor, and the forming and pouring of concrete. The second involves the removal of 4 inches of wall surface concrete, to be replaced by reinforced shotcrete. Both schemes include installation of steel angle protection for the edges of the walls.

The calculations upon which the manpower and concrete curves are based assume use of the second of these two schemes. Employment of the first scheme requires approximately half again as much concrete. Both schemes involve the use of precast panels, which are not explicitly considered in this analysis.

A large amount of reinforcing steel (.2 tons for each c.y. of poured concrete) was assumed in computing crew sizes, in order to include the manpower requirements for activities not always explicitly considered, such as stripping forms and installing precast panels.

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>Guidewall Protection</u> <u>Manpower Requirements</u> COMPUTED <u>SMA</u> CHECKED _____	PROJECT <u>Lock I Dam No. 1</u> FILE NO. <u>B22 A</u> DATE <u>1/15/52</u> or <u>65</u> PAGES
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For protection scheme w/o wall armor, a total of about 1320 c.y. of shotcrete are to be applied to vertical wall faces of the upper guidewalls, lock interior, and lower guidewall (plans 1, 2, 3). Since each of these structures is about 400 feet long, I will divide this total shotcrete evenly among the three structures:

concrete shotcrete structure
removed applied

660 c.y.	460 c.y.	upper guide walls
660 "	460 "	lower " "
660 "	460 "	lock interior walls

Double the usually assumed reinforcement quantity will be included, in order to cover the extra time required to install anchor bolts and upper protection steel angle.

reinforcement	structure
184 tons	U.g.W.
184 "	L.g.W.
184 "	lock interior

Manpower requirements are determined using the Means Cost Data book, as for other activities included in this report.

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HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>Bor Chart-Lock</u> <u>Interior Work Manpower</u> COMPUTED <u>SMA</u>	PROJECT <u>Lock & Dam No 1</u> FILE NO <u>801 A</u> DATE <u>3/27/75</u> PAGE <u>53</u> OF <u>65</u>
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Activity

	WEEK NUMBER
a) clean surfaces	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
b) repair floor	<u>3 3 3 3 3 3 3 3</u>
m) drill grout holes	<u>3 3 3 3 3 3 3 3</u>
b) orifice drilling	<u>8 8</u>
p) orifice drilling	<u>4 4 4 4</u>
c) " conc. rem.	<u>4 4</u>
" "	<u>2 2 2 2 2</u>
d) wall conc. rem.	<u>3 2 2 2 2 2 2 2 2 2 2 2 2</u>
e) clear wall conc.	<u>1 1 1 1 1 1 1 1 1 1 1 1 1 1 1</u>
i) orifice reinf (lw)	<u>2 2 2 2</u>
" (i.w)	<u>2 2 2 2</u>
j) " forms (l.w)	<u>1 1 1 1</u>
" (i.w)	<u>1 1 1 1</u>
k) " conc. (l.w)	<u>3</u>
" (i.w)	<u>3</u>
l) strip forms (lw)	<u>1</u>
" (i.w)	<u>1</u>
n) pump grout	<u>3 3 3 3 3 3 3</u>
f) wall reinf.	<u>8 8 8 8 8 8</u>
g) " shotcrete	<u>5 5</u>
h) clean "	<u>1</u>
a) rem. stoney gate	<u>4 4</u>
b) rem. m.g. operat.	<u>4</u>
c) " v. blkhd. conc.	<u>2 2 2 2 2 2</u>
d) rem base conc.	<u>3</u>
e) m.g. emb. pts.	<u>1</u>
f) " " reinf.	<u>1</u>
g) " forms	<u>1</u>
h) " conc.	<u>2</u>
i) v. blk. emb. pts.	<u>12 12</u>
j) " " reinforce.	<u>1</u>
k) " formwork	<u>1</u>

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HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>Bar Chart - Lock</u> <u>Int. Work Manpower (cont.)</u>	PROJECT <u>LOCK & Dam #1</u> FILE NO. <u>800 A</u> DATE <u>3/27/75</u> PAGE <u>54</u> OF <u>65</u> PAGE
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SUB-TOTALS
(Manpower)

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HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>Addendum to Interior</u> <u>Work Manspower Barschart</u> COMPUTED <u>IMA</u>	Project No. <u>K + D - N 1</u> FILE NO. <u>301 A</u> DATE <u>3/28/76 pag 55 or 65</u>
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Week Number

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Previous	6	66	64	66	57	44	27	29	12	5									
Totals	54	66	64	74	42	30	29	21	16	8									

2. Top of
walls & ends
of lock (cont.)

- v) rem. blk hd conc.
- w) inst. "emb. pts.
- x) " " reint.
- y) " " formwk
- z) " " concr.
- aa) reint. wall slab
- ab) form " "
- ac) pour " "

44
4
4
5
8

5555556666

New	6	70	68	66	61	53	45	34	18	11
Totals	58	70	64	74	51	39	34	27	22	8

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HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Bar Chart-Lock Upstream Work Manpower COMPUTED SMA	PROJECT Lock & Dam No. 1 FILE NO 800 A DATE 3/27/75 PAGE 56 or 65 PAGES CHECKED
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Activity	Week Number
1 Landward side	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
a) u.g.w. sht. piling	<u>2 2 2 2</u>
b) rem. u.g.w. monos.	<u>3 3 3</u>
c) lower u.g.w. found.	<u>2</u>
d) rem. culv. concr.	<u>8</u>
e) plug land w. intakes	<u>5</u>
f) form " int. man.	<u>4 4</u>
reinf. " " "	
pour " " "	<u>4 4 4 4 4</u>
	<u>3</u>
2 Intermediate	<u>8 8 8</u>
a) remove mon. #1	<u>5 5</u>
b) plug intakes	<u>4</u>
c) rem. culv. concrete	<u>11 11</u>
d) form intake manif.	<u>8 8</u>
reinf. " " "	<u>4</u>
pour " " "	<u>5 6 6</u>
	<u>3</u>
3 Apron	
a) excavate (sand)	<u>2</u>
b) apply grav. bed.	<u>2</u>
c) form 3" conc. slab	<u>6</u>
reinf. " " "	<u>4 4 4 4</u>
pour. " " "	<u>8 8</u>
Cleanup	<u>5 5</u>
4. Guidewalls	
a) rem. face concr.	<u>2 2 2 2 2 2 2 2 2 2 2 2</u>
b) reinf. " " "	<u>8 8 8 8 8 8</u>
c) apply " " "	<u>5 5</u>
TOTALS	4 10 17 17 43 10 25 17 13 5 6 8 17 29 25 14 20 13 10 0

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HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Bar Chart-Lock Downstream Work Manpower COMPUTED SMA	PROJECT Lock + Dam No. 1 FILE NO 800 A DATE 3/27/75 PAGE 57 OF 65 PAGES CHECKED
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Activity

Manifolds	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
a) sht piling	<u>3</u>
b) rem. l.g.w. monos.	<u>7 9</u>
c) rem. timber cribs.	<u>2</u>
d) excavation (mono.)	<u>2</u>
e) clear apron	<u>1</u>
f) remove "	<u>9 9</u>
g) excavate (sandst)	<u>1</u>
h) form manifolds	<u>6 6</u>
reinf. "	<u>8 8</u>
pour "	<u>4</u>
i) form l.g.w. monos.	<u>10 12</u>
reinf. " "	<u>10 12</u>
pour " "	<u>10</u>
k) inst. drain pipe	<u>4</u>
l) backfill " "	<u>12</u>
m) cutoff std. manif.	<u>4</u>
n) rock protection	<u>2</u>
o) exc. sandst. (int. w.)	<u>2</u>
p) form int. w. extension	<u>10 10 10</u>
reinf. " "	<u>15 15 15</u>
pour " "	<u>8 8</u>
q) backfill l.g.w. mono.	<u>2</u>
r) cleanup	<u>5 5</u>
guidewalls	
a) rem. vert. face conc.	<u>2 2 2 2 2 2 2 2 2 2 2 2</u>
b) reinf. " " "	<u>8 8 8 8 8 8 8 8 8 8 8 8</u>
c) apply " " "	<u>5 5</u>
TOTALS	3 13 13 28 8 28 12 37 16 10 11 14 6 20 28 26 35 35 18 0

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>Concrete Pours-</u> <u>Lock Interior & Exterior</u> COMPUTED <u>SMA</u>	PROJECT <u>LOCK + Dams N. 1</u> FILE NO <u>800 A</u> DATE <u>2/27/78</u> PAGE <u>58</u> OF <u>65</u> PAGES CHECKED _____
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Location of Concrete Pour	Week No.
INTERIOR	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
1. Walls (shutter.)	<u>230</u> <u>230</u>
2. orifices - land w.	<u>130</u>
3. " - int. w.	<u>130</u>
4. mt. gt. operator	<u>10</u>
5. valve bulkhds.	<u>80</u>
6. shear keys	<u>52</u>
7. culvert ceilings	<u>120</u> <u>120</u> <u>120</u> <u>200</u> <u>200</u> <u>200</u> <u>250</u> <u>250</u> <u>250</u>
8. lowered culverts	<u>70</u>
9. upper culverts	<u>225</u> <u>225</u> <u>225</u> <u>225</u>
10. lock bulkhds.	
11. wall caps	
SUBTOTAL -	0 0 0 0 120 580 520 80 455 225
INTERIOR	0 0 52 120 120 522 450 225 715 0
UPSTREAM	
1. landwd. int. man.	<u>800</u>
2. interm. int. man.	
3. top of monol. #1	<u>580</u>
4. apron	<u>700</u>
5. guidewall faces	<u>460</u>
SUBTOTAL - UPSTR	0 0 0 0 700 580 0 460 0 230
	0 0 0 700 0 0 0 800 230 0
DOWNTSTREAM	
1. disch. manit.	<u>450</u> <u>450</u>
2. lower guidewall	<u>1300</u>
3. intermed. wall	
4. cutoff wall	<u>1080</u>
5. guidewall faces	<u>1250</u>
SUBTOTAL -	0 0 0 1300 0 0 450 0 1250 230
DOWNTSTREAM	0 0 0 1300 0 450 0 0 1480 0
TOTAL CONCRETE	0 0 0 1300 820 1160 970 540 1705 685
	0 0 52 1900 120 1020 450 1025 2425 0

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>Manpower Levels for Upstream Work</u>	PROJECT <u>Lock + Dam N</u>
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Plan No. 1	(a)	amt unit	crew	duction	(b)	daily pro-	(w)	(d)
Work Type								
1. Landward Intake Man.								
a) v.g.w. monoliths 1+2 sh. piling	21 tons	9 men	9	30				
b) remove " " of v.g.w.	550 c.y.	B-5	8	40				
c) lower v.g.w. foundation 3 ft.	1000 c.y.	IFEL	2	560				
d) remove culvert concrete	110 c.y.	B-5	8	10				
e) plug land wall intakes	60 c.y.	C-14	30	38				
f) form land intake manifold	6450 s.f.	C-1	4	215				
reinf. " " "	160 tons	4 rods	4	2.3				
pour " " "	800 c.y.	C-7	8	80				
2. Intermediate Intake Man.								
a) remove top of mon. #1 conc.	1,150 c.y.	B-5	8	40				
b) plug interm. wall intakes	60 c.y.	C-14	30	38				
c) remove culvert concrete	90 c.y.	B-5	8	10				
d) form interm. wall intake man.	2500 s.f.	C-1	4	215				
reinf. " " " "	116 tons	4 rods	4	2.3				
pour " " " "	580 c.y.	C-7	8	80				
e) form top of monolith #1	3,950 s.f.	C-2	5	260				
reinf. " " " "	92 tons	4 rods	4	3.0				
pour " " " "	460 c.y.	C-7	8	95				
3. Upstream Apron								
a) excavate (sand)	3,000 c.y.	IFEL	2	560				
b) apply gravel bedding ("")	350 c.y.	IFEL	2	500				
c) form concrete slab (2")	slab		6	-				
reinf. " " "	140 tons	4 rods	4	23				
pour " " "	1,400 c.y.	C-7	8	100				
4. Guidewalls								
a) remove vertical face conc.	660 c.y.		1	8				
b) reinforce " " " "	184 tons rods		4	16				
c) apply " " " "	460 c.y.		5	20				

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Lock + Dam No. 1
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(1) duration
daily prod. (weeks)
duration
size (8 hrs.) $\frac{1}{8} \times 2.5 \times 6$

9	30	$\frac{1}{6}$	4	say 2	1-5
8	40	1	3	3	5-8
2	560	$\frac{1}{6}$	1	say 2	8
8	10	1	1	8	8
30	38	$\frac{1}{6}$	1	5	9
4	215	2	2	4	9-11
1	2.3	5	5	4	11-16
8	80	1	3	3	16

Allowed Activity Duration (Weeks)	Req'd avg. weekly crew size	Week no.s	Concrete Pours t.y./week
say 2	say 2	1-5	
3	3	5-8	
1	say 2	8	
1	8	8	
1	5	9	
2	4	9-11	
5	4	11-16	
3	3	16	800

8	40	2	3	8	5-8
30	38	$\frac{1}{6}$	1	5	10
8	10	5	1	4	8
4	215	1	2	4	9-11
4	2.3	4	2	8	9-11
8	80	$\frac{1}{2}$	3	4	11
5	260	1	2	5	13
4	3.0	3	2	6	13-15
8	95	5	3	3	15

Allowed Activity Duration (Weeks)	Req'd avg. weekly crew size	Week no.s	Concrete Pours t.y./week
3	8	5-8	
1	5	10	
1	4	8	
2	4	9-11	
2	8	9-11	
3	4	11	580
2	5	13	
6	6	13-15	
2	3	15	460

2560	$\frac{1}{6}$	1	say 2	1
2500	$\frac{1}{6}$	1	say 2	2
6	1	1	6	3
4	2.3	4	4	4-8
8	100	2	8	8-10

Allowed Activity Duration (Weeks)	Req'd avg. weekly crew size	Week no.s	Concrete Pours t.y./week
1	2	1	
1	2	2	
1	6	3	
4	4	4-8	
2	8	8-10	700

1	8	27	15	2	2-17
4	1.6	12	6	8	12-18
5	20	2	2	5	18-20

Allowed Activity Duration (Weeks)	Req'd avg. weekly crew size	Week no.s	Concrete Pours t.y./week
15	2	2-17	
6	8	12-18	
2	5	18-20	230

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Manpower Levels for Downstream Works COMPUTED SMA	PROJECT Lock & Dam No. FILE NO. 820 A DATE 3/20/75 PAGE 11
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Work Quantities - Plan No. 1

Work Type	amount	unit	crew	type	size	duration (week)
	@				(8 hr.)	
Manifolds						
a) install sheet piling	1.	s.f.	B-30	3	500	
b) remove l.g.w. monos. 1,2, + 3	1,100	c.y.	B-5	9	40	
c) rem. timber cribs	?		2	2		
d) excavation for new monos.	280	c.y.	B-10FF	2	560	
e) back fill l.g.w. monolith	250	c.y.	B-10FF	2	250	
f) clean apron + slab	500	c.y.	B-10FF	2	250	
g) remove " "	1,100	c.y.	B-5	9	30	
h) excavate (sandstone)	1,000	c.y.	B-10	2	100	
i) manifold forms	10,000	s.f.	C-1	4	215	
" reinf.	180	tons	4 rod.m	4	3.0	
" pouring	900	c.y.	C-7	8	150	
j) l.g.w. man. mon. forms	7,500	s.f.	C-2	5	235	
" " reinf.	260	tons	4 rod.	4	2.3	
" " pouring	1,300	c.y.	C-7	8	80	
k) install drain pipe (12" + 24" d)	705	ft.	B-21	4	110	
l) backfill on drains (gravel)	200	c.y.	1 (lab)	1	12	
m) cutoff wall + downstream manif.	1080	c.y.	B-11	2	90	
n) place rock protection	650	c.y.	B-10	2	100	
o) excavate sandstone (int. wall)	300	c.y.	B-10	2	100	
p) interm. wall extension forms	13,000	s.f.	C-2	5	200	
q) " " " reinf.	350	tons	4 rod.m	4	2.3	
r) " " " pouring	2,500	c.y.	C-7	8	95	
Guidewalls						
a) remove vert. face concrete	660	c.y.	1	8		
b) reinf. " " "	184	tons	4	16		
c) apply " " "	460	c.y.	5	20		

notes: 1. For jobs which require less than 1 week,
 2. Jobs completed before the allotted time

WORKS Lockt Dam No. 1
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(b) * From Means Cost Data, 1975 ed.

daily

prod. ew size (8 hr.)	duration uction (weeks)	Allowed Activity Duration (weeks)	Reg'd avg. weekly crew size	Week Nos.	Concrete Pours C.y./Week
3	500	6	3	1	
9	40	2	9	2-4	
2		1	2	3	
2	560	8	2	4	
2	250	reg.	say 2	15	
2	250	reg.	1	4	
9	30	2	9	4-6	
2	100	1	2	5	
4	215	3	6	7-9	
4	3.0	4	8	7-9	
8	150	1/2	4	9	450
5	235	2	10	10-12	
4	2.3	8	16	10-12	
8	80	2	16	12	1300
4	110	1	4	6	
1	12	2	12	7	
2	90	1	say 4	8	1080
2	1000	1	2	13	
2	100	1	2	9	
5	200	6	10	14-17	
4	23	10	15	14-17	
8	95	2	18	17-19	1250
1	8	27	2	2-17	
4	1.6	12	8	12-18	
5	20	2	5	18-20	230 -

than 1 week, the crew size is averaged over a whole week.
Allocated time nevertheless employ full crews for the allotted time.

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HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>Manpower levels -</u> <u>Interior Work</u>	PROJECT <u>Lock + Dam No.</u> <u>FILE NO. 800 A</u>
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1. Base + vertical face of wall - Plan No. 1	amount	unit	type
work type			
a) clean surfaces	100	lock	
b) inspect + repair floor + floor slabs	lock		
c) break out cond. opngs. - land w.	110	c.y.	
" " " " - int. w.	100	c.y.	
d) Remove wall face concrete	660	c.y.	
e) Clear " " " "	660	c.y.	
f) " " " " reinforcem. " "	184	tons	
g) " " " " shotcrete " "	460	c.y.	
h) Clean up shotcrete	lock		
i) Orifice reinforcem. - land w.	26	tons	
" " " " - int. w.	30	tons	
j) " formwork - land w.	2200	s.f.	
" " " - int. w.	1500	s.f.	
k) " concrete - land w.	130	c.y.	c-7
" " " - int. w.	150	c.y.	c-7
l) strip orifice fmwk - land w.	2200	s.f.	
" " " " - int. w.	1500	s.f.	
m) drill grout holes - int. w.	132	holes	
n) pump grout - int. w.	132	holes	
o) drill 2" orifice holes - 8/orifice - land wall	80	holes	
p) " " " " " " - int. wall	80	holes	

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Lock & Dam No. 1	HARZA ENGINEERING COMPANY CHICAGO	SUBJECT	PROJECT
800 A			FILE NO.
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crew unit	Daily Prod. type	Duration size(20 hr.)	Allowed (weeks)	Regd avg. week- act. duration by crew size	Week Nos.	Concrete c.y./week
c.y.	2	-	7	5	3	2-9
c.y.	4	14	2	2	4	2-4
c.y.	4	14	2	5	2	2-7
c.y.	4	4	27	15	2	2-17
c.y.	1	20	6	15	1	2-17
tons	4	25	12	6	8	11-17
c.y.	5	50	2	2	5	17-19
tons	3	3	1	6	4	20
tons	4	4	2.5	2	2	7-11
tons	4	4	2.5	2	2	7-11
s.f.	9	750	2	4	1	14-18
s.f.	9	750	2	4	1	14-18
c.y.	c-7	8	100	5	3	18
c.y.	c-7	8	100	5	3	18
a.f.	4	3000	6	1	1	20
s.f.	4	3000	6	1	1	20
holes	3	3	3	7 1/2	3	2-10
holes	3	3	6	3 1/2	3	6-10
holes	3	3	4	3 1/2	2	2-4
holes	3	3	4	3 1/2	4	2-6

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>Man power levels -</u> <u>Interior Work</u>	PROJECT <u>Lock & Dam No. 1</u>
	COMPUTED <u>SMA</u>	FILE NO <u>800 A</u>
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Work Quantities - Plan No. 1

2. Top of walls, ends of lock

Work Type	Amount	Unit	Type	Size	Crew
a) remove stoney gate	4	-		4	
b) remove miter gate operator	4	-		4	
c) remove valve bulkhead concr.	160	c.y.		4	
d) remove loose concrete	160	c.y.		5	
e) install mt.gt. op. embedded pts	4	-		4	
f) " " " reinforcement	.5	ton	rod.m.	4	
g) " " " formwork	100	s.f.	C-2	5	
h) Pour " " " concrete	10	c.y.	C-7	8	
i) install valve blkhd. embedded pts.	6	-		3	
j) " " " reinforcement	7	tons	rod.m.	4	
k) " " " formwork	200	s.f.	C-2	5	
l) Pour " " concrete	80	c.y.	C-7	8	
m) strip forms	300	s.f.		1	
n) install new mt.gt. operator	4	-		4	
o) drill shear Keys (vert. + horiz.)	8	holes		6	
p) pour shear Keys (" ")	52	c.y.	C-7	8	
q) misc. (mooring bits, etc.)				30	
r) upper miter gate repairs	1	lock		9	
s) lower " " "	1	lock		14	
t) upper miter gate sandbl. & pntng.	1	lock		4	
u) lower " " "	1	lock		4	
v) remove lock blkhd concrete	140	c.y.		4	
w) install " " embedded parts	4	-		4	
x) " " " reinforcement	14	tons	rod.m.	4	
y) " " " formwork	500	s.f.	C-2	5	
z) pour " " concrete	70	c.y.		8	
aa) reinforce slab on tops of walls	180	tons	rod.m.	4	
ab) form " " "	20,000	s.f.	C-2	5	
ac) pour " " "	900	c.y.	C-6	6	

FOR USE ON U.S. GOVERNMENT WORK ONLY

PROJECT <u>JACK Dam No. 1</u>	SUBJECT _____	PROJECT _____
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Type	Crew Size	Daily (20 hr.) Production	Duration (weeks)	Activity	Weekly Duration	Crew Size	Allowed	Req'd avg.	Concrete c.y./week
							Week Nos.	Week Nos.	
	4	—	2		2	4	2-4	5	
	4	—	1 1/3		5	4	5	6	
	4	15	2		6	2	4-10	10	
	5	100	3		3	2	10	18	
	4	—	1 1/6		2	4	8	9	
rod.m.	4	42	1 1/6		1	1	9	10	
C-2	5	250	4 1/6		1	1	10	11	
C-7	8	40	4 1/6		1	2	11	12	10
	3	—	7		2	12	12	13	
rod.m.	4	42	7		1	2	13	14	
C-2	5	250	8 1/3		1	1	14	15	
C-7	8	40	8 1/3		2	3	15	16	80
	1	600	8 1/3		1	1	16	17	
	4	—	2 2/3		3	4	14-17	4-6	
	6	—	2 2/3		2	6	6	6	
	8	40	2 2/3		2	8	2-17	2-17	
C-7	8	40	2 2/3		1	15	3-6	3-6	
	30	—	1		3	3	6-9	6-9	
	9	—	3		3	3	6-10	6-10	
	14	—	3		4	4	10-14	10-14	
	4	—	4		4	4	9-11	9-11	
	4	—	4		4	4	11	11	
	4	—	15		2	1	12	12	
	4	—	1		1	1	13	13	
rod.m.	4	42	1		1	2	13	13	
C-2	5	250	1 1/2		1 1/2	3	2-6	2-6	
rod.m.	8	40	1 1/3		1 1/3	3	70	70	
C-2	4	75	4		4	5	10-16	10-16	
C-6	6	250	6		6	6	16-20	16-20	225
	6	287	4		4	6			

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>lock Interior</u> <u>Work Scheduling, Plan 1</u> COMPUTED SMA	PROJECT <u>Lock + Dam N</u> FILE NO. <u>300 A</u> DATE <u>3/21/75</u> PAGE <u>1 of 1</u>
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Work Quantities - Plan No. 1

3. Culverts - interior of lock walls

Work Type	Amount	Unit	Type	Size	Crew
a) drill grout holes (int. wall only)	198	holes			3
b) inject grouting (" " ")	198	holes			3
c) enlarge vents in culverts	400	ft.			2
d) cut culvert ceiling break-line	1600	ft.	A1		2
e) remove " " concrete	100	c.y.			2
f) install " " Vent pipes	400	ft.			3
g) grout " " "	10	c.y.			3
h) pour " " Concrete	600	c.y.	C-7		8
i) remove conc. to lower culverts	1200	c.y.	B-9		8
j) form new lower culverts	2000	s.f.	C-1		4
k) reinforce " " "	160	tuns	4 rod m		4
l) pour conc. for " "	800	c.y.	C-7		8
m) reinf. upper culverts & gate slots	80	tuns	4 rod m		4
n) fill " " " " "	1000	c.y.	C-7		8
o) install new slide valves	2	valve			3
p) drill 2" orifice holes - 8/orifice	80	holes			3

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Crew Type	Crew Size	Daily (8-hr.) Production	Duration (Weeks)	Activity	Allowed	Req'd Avg.	Week Nos.	Concrete C.y./week
					Weekly Duration	Crew Size		
As	3	1.2	11	8	6	2-10		
les	3	2.4	5½	8	3	3-11		
	2	10	4	2	4	2-4		
A1	2	182	4	1	8	4		
	2	5	2	2	2	5-7		
	3	80	5½	3	1	7		
	3	.5	8	1	1	7		
C-7	8	50	1	5	use 4	8-15	120	
B-9	8	70	1½	3	4	7-7		
C-1	4	170	1	3	2	8-11		
uns 4 rod m	4	18	6	3	8	7-10		
C-7	8	160	1	4	2	11-15	200	
uns 4 rod m	4	1.8	3	3	4	7-10		
C-7	8	120	1½	4	use 2	11-15	250	
valve	3	—	1½	2	2	15		
oles	3	1.6	3½	4	3	2-6		

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HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>Manpower & concrete</u> <u>Weekly Volumes-Summary</u>	PROJECT <u>Lock + Dam N</u>
	COMPUTED <u>SMA</u>	FILE NO <u>800 A</u>
		DATE <u>3/20/75</u> REVIS'D <u>3/22/75</u>

Week no.	Upstream		Downstream	
	labor (men)	concrete (c.y.)	labor (men)	concrete (c.y.)
NOV.	1	4	0	3
	2	6	0	11
	3	10	0	13
Dec.	4	8	0	14
	5	17	0	13
Jan.	6	17	0	6
	7	17	0	28
Feb.	8	29	700	20
	9	43	700	8
March	10	25	0	28
	11	10	580	28
	12	14	0	26
	13	25	0	12
	14	20	0	35
	15	17	460	37
	16	13	800	35
	17	13	0	16
	18	10	230	18
	19	5	230	10
	20	0	0	0

FOR USE ON U.S. GOVERNMENT WORK ONLY

PROJECT <u>Lock & Dam No. 1</u>	SUBJECT <u>300 A</u>	COMPUTED	CHECKED	PROJECT
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Downstream en)	Subtotal		Lock Interior		Total	
	Concrete (c.y.)	Exterior labor (men)	Concrete (c.y.)	labor (men)	Concrete (c.y.)	labor (men)
	0	7	0	6	0	13
	0	17	0	58	0	75
	0	23	0	70	0	93
	0	22	0	70	0	92
	0	30	0	68	0	98
	0	23	0	64	52	87
1300	45	1300	66	0	111	1300
1080	49	1780	74	120	123	1900
	0	51	700	61	120	112
	0	53	0	51	120	104
	0	38	580	53	580	94
450	40	450	39	570	79	1020
450	37	450	45	520	82	970
	0	55	0	34	450	89
	0	54	460	34	80	89
	0	48	800	27	225	75
1250	29	1250	18	455	47	1705
1480	28	1710	22	715	50	2425
230	15	460	11	225	26	685
	0	0	8	0	8	0

FOR USE ON U.S. GOVERNMENT WORK ONLY

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT <u>Manpower + Concrete</u> <u>Flow Levels - Plan No. 1</u>	PROJECT <u>Lock + Dam No. 1</u>
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